PAGE'S WEEKLY.—May 5, 1905. Thin Paper Copy for Circulation Abroad.

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PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES. CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

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RUSSIA, St. Petersburg: 14, Nevsky Prospect.
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PAGE'S WEEKLY

Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

Telephone No.: 5754 Bank. Write for particulars.

PAGE & ROWLINGSON,

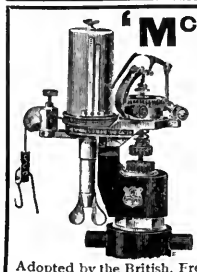
Chartered Patent Agents.

Mr. PAGE, who is a Whitworth Exhibitioner and an Associate Member of the Institute of Civil Engineers, has had a large experience as a Practical Mechanical Engineer, and is specially qualified to deal with the most intricate mechanical problems successfully. *Write for Handbook of Information Free.*

28, NEW BRIDGE STREET, LONDON, E.C.,
And 14, St. Ann's Square, Manchester.

HIGH SPEED INDICATORS.

Hannan & Buchanan,
75, Robertson Street, Glasgow.
ENGINE COUNTERS.
BOURDON GAUGES.
On Admiralty List.
Engineering Instrument Makers



'McINNES-DOBBIE' INDICATORS.

In Two types: External and Enclosed Pressure Springs.
Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

DOBBIE McINNES, LIMITED,
Adopted by the British, French, and Japanese Admiralties. **45, BOTHWELL ST., GLASGOW.**

THE ACME WATER STORAGE and CONSTRUCTION CO., Ltd.,

Patented March 9th, 1897. U.S.A.

Water stored where most convenient under pressure and automatically distributed.

For Town and Village Supplies, Suburban Establishments, High Buildings, Factory Sprinklers, etc.
Descriptive Circular sent on request.

ERIC S. A. SMITH, Water Supply Engineer, BRIDLINGTON.
Licensee, Sole Agent, and Manufacturer for the United Kingdom and Colonies.

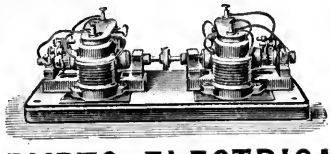
WAYGOOD LIFTS

APPLY FOR CATALOGUE.

FALMOUTH ROAD, LONDON, S.E.

Alternating to Continuous Motor Generators.

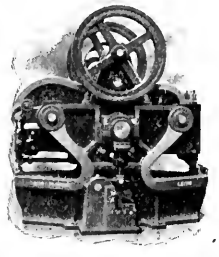
DYNAMOS



ALTERNATORS

THE CRYPTO ELECTRICAL CO.,

Telephone: 12830 CENTRAL.
3, Tyers Gateway, BERMONDSEY ST., S.E.



PUNCHING & SHEARING Machines.
STEAM HAMMERS.
Shipbuilders' MACHINE TOOLS.

DAVIS & PRIMROSE,

Leith Ironworks, EDINBURGH.

BABCOCK & WILCOX, Ltd.

PATENT WATER-TUBE BOILERS.

These Boilers are in use throughout the world to the extent of 4,700,000 h.p. generating steam for all purposes, and fired with all kinds of fuel.
See our Advertisement appearing May 12th, page 37.
HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
WORKS—Renfrew, SCOTLAND.

GRAHAM, MORTON & Co. LTD.

Head Office and Works, LEEDS.

Makers and Erectors of all Classes of
CONVEYING PLANTS, COAL HANDLING PLANTS
AERIAL ROPEWAYS, &c., &c.

HEAD, WRIGHTSON & CO., LTD.,

STOCKTON-ON-TEES,

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ENGINEERING PHOTOGRAPHY

Price List on application to—
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BOOKER & SULLIVAN,
Telephone: 9252 Central.

LONDON, W.C.

PAGE'S WEEKLY — Miscellaneous

HARTLEY & SUGDEN LIMITED — TRADE MARK — H & S Hx — HALIFAX

Heating Apparatus

BOILERS

Wrot Welded Iron and Cast Iron Sectional

VERTICAL STEAM BOILERS

Apply for Catalogue.

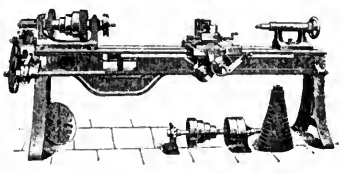
TRANSPORTERS.

See our Advertisement appearing May 12th.

TEMPERLEY TRANSPORTER CO.,

72, Bishopsgate Street Within, LONDON, E.C.

Telephone: 365 London Wall. Telegrams: "Transumo."



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MACHINE TOOLS

In stock for immediate delivery.

THOS. W. WARD, LD.

Albion Works,

SHEFFIELD.

J. FREDK. MELLING,

14, Park Row, LEEDS, ENGLAND.

Iron & Steel Bars, Plates, Sheets, Girders, Channels, Angles, Rails, Blooms, Billets, & Slabs.

Write for Section Lists and Prices.

Telegrams: "LEGATION, LEEDS."

J. TOMEY & SON'S EUREKA GAUGE GLASS — ESTABLISHED 1853 — ASTON BIRMINGHAM.

A NEW GAUGE GLASS.

Samples, Lists, and Testimonials on application.

"S. H. P."

Tested to 350 lb. Steam Pressure.

For High Pressure Boilers.

BRETT'S PATENT LIFTER CO., LTD.

COVENTRY, ENG.

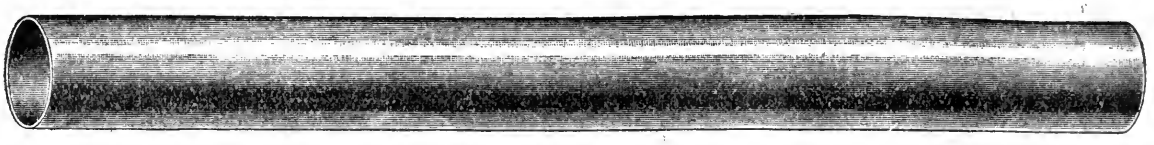
Speciality—

FORGING PLANT.

See our Advertisement appearing May 12th.

SEND FOR LATEST CATALOGUE.

WELDED AND RIVETED STEEL PIPES.



THOMAS PIGGOTT & CO., LTD., SPRING HILL, BIRMINGHAM. **Send for Catalogue.**

SHONE PNEUMATIC EJECTORS

FOR RAISING SEWAGE, SLUDGE, WATER, &c.

Air Compressing Machinery

FOR ALL SERVICES.

HUGHES & LANCASTER

47, VICTORIA STREET, LONDON, S.W.

M. GLOVER & CO., LEEDS,

SAW MILL ENGINEERS.

"IDEAL" GUARDS, BENCHES, SHARPENERS, FIREWOOD, and LIGHTER PLANTS,

Saving in Wages alone means

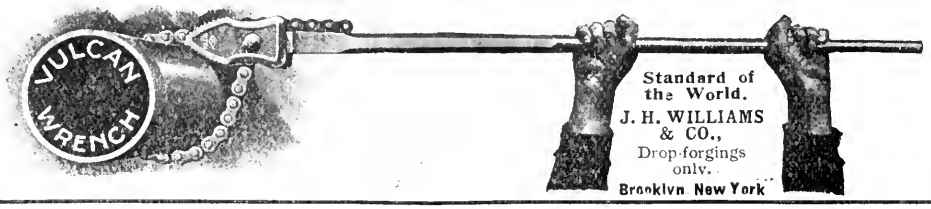
A CERTAIN LARGE INCOME.

MALLEABLE IRON & STEEL CASTINGS FOR ENGINEERS & TOOL MAKERS

TO MACHINE CLEAN & BRIGHT ALL OVER.

PARKER FOUNDRY CO. DERBY

ON ADMIRALTY LIST.



Standard of the World.

J. H. WILLIAMS & CO.,

Drop-forgings only.

Brooklyn New York

PAGE'S WEEKLY

Miscellaneous

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Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.

ZEITZ & Co., 21, Lime St., London, E.C.

HIGH-CLASS NON-CORROSIVE
LUBRICATING OILS AND SOLIDIFIED LUBRICANTS.
(Castor, Lard, Olive, Neatsfoot, and Linseed Oils, Tallow, &c.)

RELIANCE LUBRICATING OIL CO.,
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LONDON, E.C.
Also at GLASGOW, HULL, BRISTOL, AND NEWCASTE-ON-TYNE.

GREENWOOD & BATLEY, Ld.

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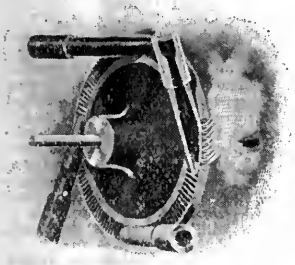

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Dynamos & Motors.

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STONE BREAKERS,

GRAVEL WASHERS, ETC.
SAMUEL PEGG & SONS, Engineers,
LEICESTER, England.

SEND FOR ILLUSTRATED CATALOGUE.

Refuse Destructors.

Write for particulars to:—

HEENAN & FROUDE, LIMITED,
4, Chapel Walks, MANCHESTER.

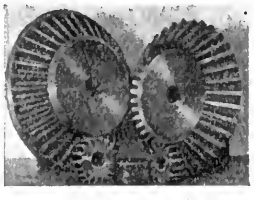
Works: MANCHESTER and WORCESTER.

AVERY'S NEW PROPELLER BLADE.

Patent No. 1446, 1904.
See PAGE'S WEEKLY, April 14th issue, p. 786.
Firms specialising in Marine or Ventilating Work are invited to communicate with reference to manufacture under licence to—
A. H. AVERY, Fulmen Works, Tunbridge Wells.

RIVETS, BOLTS, & SCREWS

Of all Descriptions and for all Purposes.
SEND FOR CATALOGUE.
T. D. ROBINSON & CO., Ltd.,
DERBY.



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A SPECIALITY.
Also all kinds of Metal Gearing.
AD. AHLERS,
Whitley Bay, Newcastle-on-Tyne.

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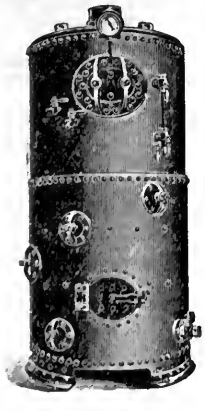
Journey
Speed
} RECORDERS.

For further particulars . . of our . . see our whole page Ad. on May 12th.

TIME RECORDERS

RECORDERS, LTD., 171, Queen Victoria Street, LONDON, E.C.



Steam Boilers

(OF ALL TYPES AND POWERS).

Manufactured by
The GRANTHAM CRANK and IRON CO., Ltd.,
GRANTHAM.

DESTRUCTORS and CLINKER MACHINERY.

Horsfall Destructor Co., Ltd., Armley, Leeds.
Telegrams: "DESTRUCTOR." Telephone: 2000.
Codes: A.B.C. (5th Edition) and Leiber's.

WALTER SCOTT, LTD.,

LEEDS STEEL WORKS, LEEDS, ENGLAND.

MANUFACTURERS OF . . .
Rolled Steel Joists, Channels, etc.
Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds and Flats.
Speciality: **TRAMRAILS.**

PAGE'S WEEKLY

Contracts

CONTRACTS.

REFUSE DESTRUCTOR AND FLAG-MAKING PLANT.

MUNICIPAL COUNCIL OF THE CITY OF SYDNEY, NEW SOUTH WALES.

The Municipal Council of the City of Sydney, New South Wales, invite TENDERS for the SUPPLY and ERECTION of SIX-CELL REFUSE DESTRUCTOR and for a FLAG-MAKING PLANT at Moore Park, within the City of Sydney, New South Wales.

Conditions of Contract, Specifications, and Tender Forms may be obtained on application to the Acting Agent-General for the State of New South Wales, Victoria Street, Westminster, S.W.

Tenders will be received up to Tuesday, May 30th, 1905, addressed to the Town Clerk, Town Hall, Sydney, New South Wales, endorsed "Tenders for Destructor and Flag Plant."

THOMAS H. NESBITT,
Town Clerk.

Town Clerk's Room, Town Hall, Sydney,
February 9th, 1905.

THE DUBLIN PORT AND DOCKS Board is prepared to receive TENDERS for an ELECTRIC GENERATING STATION.

The specification and drawings, together with a special form of Tender, can be obtained at the office of the Engineer of the Board, JOHN P. GRIFFITH, Esq., M.Inst.C.E., Fast Wall, Dublin, on payment of Five Pounds, which will be refunded to firms sending in *bona fide* Tenders.

Tenders, with contractor's supplemental specification and drawings, marked on the outside of the cover "Tender for Electric Generating Station," must be delivered by post, sealed prepaid, and addressed to the Secretary, Port and Docks Office, Westmoreland Street, Dublin, on or before Monday, the 15th day of May, 1905.

The Board does not bind itself to accept the lowest or any tender.

By order,
N. PROUD,
Secretary.

Dublin Port and Docks Office,
April 3rd, 1905.

EDINBURGH CORPORATION ELECTRICITY SUPPLY.

The Lord Provost, Magistrates, and Council invite TENDERS for the following WORK, in connection with their Electricity Supply Station at M'Donald Road :—

Specification No. 16.—WATER-TUBE BOILERS.

Copies of the specification, form of Tender, general conditions, and drawings can be obtained from the Engineer, Dewar Place, Edinburgh, after Wednesday, April 19th, upon payment of a deposit of £2 2s., which will be refunded on receipt of a *bonâ fide* Tender, and on the return of the specification, general conditions, and drawings.

The specification, general conditions, and drawings can be seen at but not obtained from, the office of Dr. A. B. W. KENNEDY, 17, Victoria Street, London, S.W.

Tenders, on the prescribed Form, enclosed in sealed envelope, and endorsed on the outside "Electricity Supply.—Tender for Specification No. 16," must be delivered at the office of the undersigned not later than Monday, May 8th, 1905.

THOMAS HUNTER, Esq.,
Town Clerk.

City Chambers, Edinburgh,
April 7th, 1905.

FEDERATED MALAY STATES.

JOHORE STATE RAILWAYS.

TENDERS FOR PERMANENT WAY MATERIALS.

THE CROWN AGENTS FOR THE COLONIES, acting on behalf of the Government of the Federated Malay States, invite TENDERS from manufactuers, as follows :—

(1) About 7,783 TONS of STEEL RAILS (80 lb.) and 681 TONS FISH-PLATES, and

(2) About 73 TONS FISH-BOLTS and NUTS and 185 TONS DOG-SPIKES.

Specifications and conditions of contract can be obtained at the office of the Crown Agents for the Colonies, Whitehall Gardens, S.W., on and after Monday, May 1st, 1905, between the hours of 10 a.m. and 4 p.m. (Saturdays 10 to 1).

A charge of £1 will be made for each specification.

This sum will be returned to each person or firm submitting a *bonâ fide* Tender properly completed in all respects within the time specified below.

Tenders to be delivered in sealed envelopes, addressed to the Crown Agents for the Colonies, Whitehall Gardens, S.W., not later than noon, May 17th, endorsed "Tenders for Permanent Way Materials."

The Crown Agents do not bind themselves to accept the lowest or any Tender.

BOROUGH OF BARROW-IN-FURNESS.

TO CONTRACTORS.

THE CORPORATION OF BARROW-IN-FURNESS Invite TENDERS for the CONSTRUCTION of a STEEL ROAD BRIDGE over the Walney Channel, uniting Barrow Island and Walney Island.

The Bridge will be about 1,123 ft. in total length between abutments and 50 ft. in width, and will consist of eight fixed girder spans, and one opening span, on cylinder foundations.

Drawings may be seen, and Specifications obtained, at the Office of the Engineer, Sir BENJAMIN BAKER, K.C.B., at 2, Queen Square Place, Queen Anne's Mansions, Westminster, on and after Monday, April 17th, 1905.

Sealed Tenders, endorsed "Tender for Bridge over Walney Channel," must be addressed to the Town Clerk of Barrow-in-Furness, and delivered at his Office, Town Hall, Barrow-in-Furness, before Noon on Monday, May 15th, 1905.

The Corporation does not bind itself to accept the lowest or any Tender.

By order,
C. F. PRESTON,
Town Clerk.

Town Hall, Barrow-in-Furness,
April 8th, 1905.

MANCHESTER CORPORATION GAS-WORKS.

TO OIL IMPORTERS AND OTHERS.

The GAS COMMITTEE of the Corporation of Manchester are prepared to receive TENDERS for the SUPPLY of OIL for the manufacture of Carburetted Water Gas. The oil to have a flashing point of not less than 73 degrees (Abel's test), and not less than any higher degree of temperature which may be specified in any future Act of Parliament or regulations to be made thereunder.

Full description, with the analysis of the oil offered, must be submitted with each Tender, as well as a sealed sample of the same. The quantity of oil to be delivered free of all charges (including Ship Canal dues) into the storage tanks of the Corporation at Trafford Wharf, on the banks of the Manchester Ship Canal, in such quantities as may be from time to time required by the Gas Committee, will be 10,000 to 15,000 tons during the Twelve Months ending September 30th, 1906. Tenders to be at a price per imperial gallon.

Further particulars may be obtained on application (in writing only), to Mr. CHARLES NICKSON, Superintendent of the Gas Department.

Sealed Tenders and samples, addresssed to the Chairman of the Gas Committee, and endorsed "Tender for Gas Oil," must be delivered at the Office of the Superintendent of the Gas Department, Town Hall, Manchester, on or before Wednesday, May 10th, 1905.

The Corporation do not bind themselves to accept the lowest or any tender.

By order of the Gas Committee,
WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
April 7th, 1905.

BISHOP'S STORTFORD URBAN DISTRICT COUNCIL.

CONTRACTS.

Subject to the sanction of the Local Government Board being obtained to the necessary loans, the COUNCIL invite TENDERS for the CARRYING OUT of the FOLLOWING WORKS at their Sewage Pumping Station—viz. :—

CONTRACT No. 1.—For Supplying and Fixing Two Lancashire Boilers, 18 feet long by 6 feet 6 inches diameter.

CONTRACT No. 2.—For Supplying and Fixing Steam Pumping Engine and Pumps.

In connection with this Contract, persons tendering are required to submit detailed Drawings and Specifications of the type of Engine and Pumps they propose to supply.

CONTRACT No. 2A.—For Supplying and Fixing Gas Pumping Engine and Pumps, together with Suction Gas Plant complete.

Printed Specifications and Forms of Tender will be forwarded on application to the undersigned. Applications to be accompanied by a deposit of £2 2s. in each case, which will be returned on receipt of a *bonâ fide* Tender.

The person or firm whose Tender is accepted will be required to enter into a written contract and to provide two sureties.

Sealed Tenders, endorsed "Contract No. —" to be sent to me by 4 o'clock p.m. on Monday, the 8th day of May, 1905.

The Council do not bind themselves to accept any Tender

By order,
THOS. SWATHERIDGE,
Clerk of the Council.

Council Offices, 7, North Street, Bishop's Stortford,
March 17th, 1905.

PAGE'S WEEKLY — Contracts

EAST INDIAN RAILWAY. — The East Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of—

(1) STEEL PLATES, ANGLE RINGS and BARS for BOILERS,
(2) COPPER FIRE-BOX PLATES,
(3) BRASS BOILER TUBES,
(4) COPPER TUBES, PIPES, and RODS,
(5) ELECTRIC EQUIPMENT for Jamalpur Electricity Supply,

as per specifications to be seen at the Company's Offices.

Tenders are to be sent to the undersigned, marked "Tender for Steel Boiler Plates," or as the case may be, not later than Twelve o'clock noon on Wednesday, the 10th day of May proximo.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each specification a fee of One Guinea is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.,
April 27th, 1905.

THE SOUTH INDIAN RAILWAY COMPANY, LIMITED, is prepared to receive TENDERS for the SUPPLY of—

(a) STEEL BRIDGES, 10 ft. to 55 ft. spans, about 1,800 tons.
(b) „ „ 20 ft. to 40 ft. „ „ 83 „

Specifications and forms of Tender may be obtained at the Company's Offices on and after Monday, May 1st.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, and marked "Tender for Bridges," must be left with the undersigned not later than 12 noon of Tuesday, May 16th, 1905.

The Company is not bound to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 20s. for each copy of specification (a), and of 10s. for each copy of (b).

Copies of the drawings may be obtained at the office of Sir GEORGE B. BRUCE, 3, Victoria Street, Westminster, on payment of 5s. per sheet.

By order,
HENRY W. NOTMAN,
Managing Director.

Company's Offices,
55, Gracechurch Street, London, E.C.,
April 28th, 1905.

COUNTY OF LONDON.

TO MAKERS OF STORAGE BATTERIES AND OTHERS.

THE LONDON COUNTY COUNCIL invites TENDERS for the SUPPLY, ERECTION at its GENERATING STATION, East Greenwich, S.E., and MAINTENANCE, for a period of ten years of a BATTERY of 280 ACCUMULATOR CELLS having capacities of 645 ampere-hours at a three-hour discharge rate, and of 450 ampere-hours at a one-hour discharge rate.

Persons desiring to submit Tenders may obtain the Specifications, Drawings, Bills of Quantities, Form of Tender, and other particulars at the County Hall, Spring Gardens, S.W., upon payment to the Cashier of the Council of the sum of £2. This amount will, after the Council or its Committee have come to a decision upon the Tenders received, but not before, be returned to the tenderer, provided he shall have sent in a *bonâ fide* Tender, and not have withdrawn the same, but in no case will the fee be returned unless a *bona fide* Tender is submitted. Full particulars of the work may be obtained on application at the County Hall, previously to the payment of the fee for the Specification, etc. Tenders must be upon the official forms, and the printed instructions contained therein must be strictly complied with. The contractors will be bound by the contract to pay all workmen (except a reasonable number of legally bound apprentices) employed by them, wages at rates not less, and to observe hours of labour not greater than the rates and hours set out in the Council's list, and such rates of wages and hours of labour will be inserted in and form part of the contract by way of schedule. Each Tender is to be delivered at the County Hall, in a sealed cover, addressed to the Clerk of the London County Council, Spring Gardens, S.W., and marked "Tender for Accumulators." No Tender will be received after 10 a.m. on Tuesday, the 16th day of May, 1905. Any Tender which does not comply with the printed instructions for Tender may be rejected.

The Council does not bind itself to accept the lowest or any Tender, and it will not accept the Tender of any person or firm who shall on any previous occasion have withdrawn a Tender after the same had been opened, unless the reasons for the withdrawal were satisfactory to the Council.

G. L. GOMME,
Clerk of the London County Council.

County Hall, Spring Gardens, S.W.,
April 19th, 1905.

APPOINTMENTS OPEN.

CITY OF LINCOLN.—PUBLIC HEALTH ACT, 1875.
LINCOLN CORPORATION WATERWORKS.
TO WATERWORKS ENGINEERS.

The Corporation of the City of Lincoln invite APPLICATIONS for the APPOINTMENT of a WATERWORKS ENGINEER.

Candidates must have had previous experience in a similar capacity with a Company or a Corporation supplying water to a town or district under Parliamentary powers, and be competent to superintend the laying of mains and the management of filter beds, engines, plant and machinery, and the general conduct of a waterworks undertaking.

The Engineer appointed will be required to devote the whole of his time to the service of the Corporation.

The salary will be at the rate of £300 per annum.

Applications, stating age, present occupation, and giving an account of previous experience, as a Water Engineer, in the Candidate's own handwriting, together with not more than three recent testimonials, must be sent to me, endorsed "Waterworks Engineer," on or before the 9th day of May, 1905.

Canvassing for the appointment will disqualify a candidate.

By order
W. T. PAGE, Jr.,
Deputy Town Clerk.

Lincoln, April 25th, 1905.

URBAN DISTRICT COUNCIL OF BEESTON.

APPOINTMENT OF SURVEYOR.

The above-named Council invite APPLICATIONS for the post of SURVEYOR and SANITARY INSPECTOR in their district at a commencing salary of £150 a year. An office will be provided by the Council.

The district adjoins the City of Nottingham, and comprises an area of about 1,600 acres, with a road mileage of 22 miles, and has an estimated population of over 11,000.

The person appointed must be fully qualified to perform the whole of the duties appertaining to the office of Surveyor and Sanitary Inspector to an Urban District Council, to prepare plans, quantities, specifications, and estimates for works, and must have a thorough knowledge of the construction and maintenance of roads. He will be required to devote the whole of his time to the duties of his office, keep all necessary books and accounts, and reside within the district.

Applications, in Candidate's own handwriting, in sealed envelope, marked "Surveyor," specifying age, qualifications, and experience, accompanied by copies of not more than three testimonials, must be sent to me on or before the 19th day of May, 1905.

Selected Candidates will have notice when to attend before the Council. The appointment of Sanitary Inspector will be subject to the approval of the Local Government Board.

Canvassing after this advertisement will be a disqualification.

Dated April 20th, 1905.

W. H. REDGATE, Solicitor,
Clerk to the Council.

Bentinck Buildings, Wheeler Gate, Nottingham.

COUNTY OF LONDON.—THE LONDON COUNTY COUNCIL REQUIRES the SERVICES of a RESIDENT ENGINEER and an ASSISTANT RESIDENT ENGINEER in the Tramways Branch of the Engineer's Department to superintend, under the direction of the Chief Engineer, the Laying of the Track Work, for the Construction of new, and the Reconstruction of existing, Tramways for electrical traction on the conduit system.

Candidates must be over 25 and under 45 years of age, and must have had considerable experience of the construction and maintenance of tramways worked by electrical traction.

The appointments will be of a temporary character. The salary of the resident engineer will be £8 a week, and that of the assistant resident engineer £5 a week.

The gentlemen appointed will be required to give their whole time to the duties of their offices, and to conform to such conditions as may be prescribed by the Council.

Forms of application for the appointments can be obtained either by personal application, or by a stamped addressed foolscap envelope, to the Clerk of the Council, County Hall, Spring Gardens, S.W.

Applications must be accompanied by copies of three recent testimonials.

The latest time for receiving applications is 10 o'clock a.m. on Monday, May 8th, 1905.

Any application which fails to comply with the terms of the form of application will not be considered.

Personal canvassing of members of the Council is strictly prohibited.

G. L. GOMME,
Clerk of the London County Council.

County Hall, Spring Gardens, S.W.,
April 22nd, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Perlam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N. 125, Strand, W.C.
World's Work and Play.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Swift, George, Claremont Ironworks, Halifax.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Portable).
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Garrett, R., & Sons, Leiston, R.S.O., Suffolk.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Avery, A. H., Park Street, Tunbridge Wells.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

PAGE'S WEEKLY

Wells' Specialities

PORTABLE LIGHT FROM OIL

UP TO 4,000 CANDLE POWER.

Adopted by 26 Governments and all Leading Firms. Over 17,000 sold. Over 1,500 supplied to British and Foreign Railways.

EACH LAMP GUARANTEED.

Horizontal Flame Unaffected by Weather.

	PRICE COMPLETE.
No. 0.—500 Candles, small hand pattern, for petroleum	£7 7 0
No. 1.—1,500 Candles, hand pattern with No. 2 size burner for Tar Oil ...	£10 0 0
No. 2.—1,500 or 2,000 Candles, useful and portable pattern	£15 10 0
No. 3. 2,500 or 3,500 Candles, Manchester Ship Canal pattern ...	£16 10 0
No. 4.—3,500 or 4,000 Candles. A most powerful lamp	£17 15 0

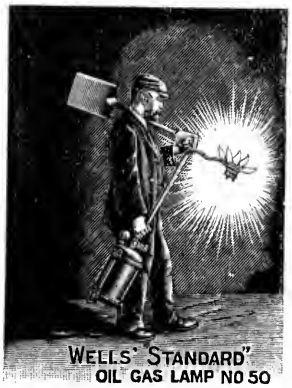
These Lamps ar arranged to burn Kerosene or Petroleum when sent to Foreign Countries; but in Great Britain our Special Wells Oil is supplied, which is half the price, and gives 30 per cent. more light. Special prices for our oil may be had on application to our Agents or direct to us.

For Electrical Engineers, Contractors, Builders, Docks, Railways, &c.

This Lamp will not blow out in a high wind, produces a clear white light of about 200 candle power, from ordinary paraffin or petroleum. The tank holds 1½ gallons of oil, burning six hours.

Price **£3** each.

Extra Burners **3/-** each.



WELLS' OIL GAS GENERATING LAMP No. 40.

Weight, 10 lb. Capacity, 7 pints Burning about 7 hours.

Made in Sheet Steel, with top and bottom of our "Unbreakable" Metal, for Lightness and Strength, with large Capacity.

Price, with Single Burner...	16/- each.
,, Double ,, ...	19/- ,,
Tripod Stands	3/- ,,
Extra Burners	2/- ,,

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,

LONDON, N.W.

WELLS' "LIGHTNING PAINTER."

(WALLWORK AND WELLS' PATENTS.)

PAINTING BY MACHINE.

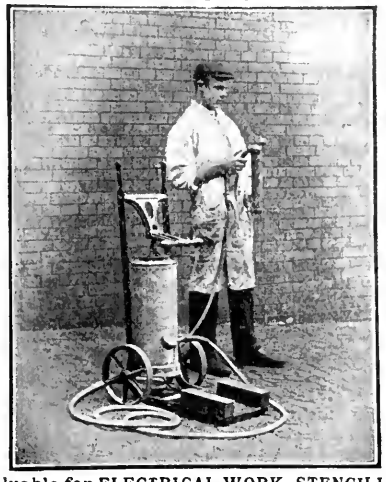
Great Saving in Time, Paint, and Labour.

PAINTING SPEED—3 square yards a minute.

The paint is sprayed evenly and continuously through a flexible tube and nozzle supplied with compressed air, either from existing air main or from our special Compressors.

No. 1 Painter (as above Illustration) ...	£25 0 0
No. 2 ,, ...	£30 0 0
No. 3 ,, ...	£35 0 0
Single Air Compressor	£17 10 0
Double Air Compressor	£27 0 0

HAND AIR COMPRESSORS, Paint Holder and Sprayer Combined.



Invaluable for ELECTRICAL WORK, STENCILLING, ORNAMENTING, DECORATING, &c.,

or any class of painting where the work is not very heavy or continuous.

Price, Complete ... ... **£16.**

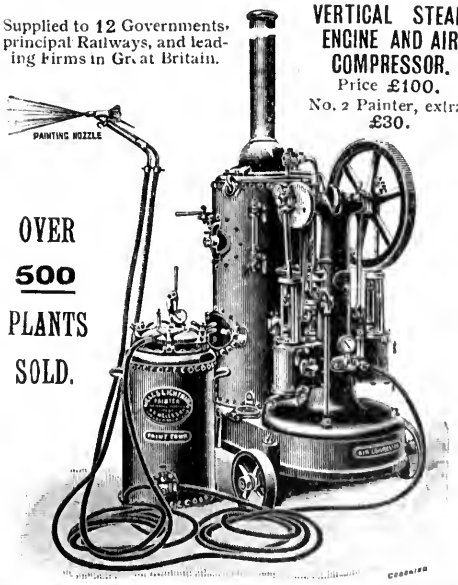
Hand Sprayer and Hose supplied separately, £9.

Supplied to 12 Governments, principal Railways, and leading Firms in Great Britain.

VERTICAL STEAM ENGINE AND AIR COMPRESSOR.

Price £100.

No. 2 Painter, extra £30.



OVER 500 PLANTS SOLD.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114 118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Highroad Well Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Claremont Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford.
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery Lane, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.

Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Claremont Ironworks, Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.

Williams, J. H. & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Steel Structures.

Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 10, St. George's Crescent, Liverpool, and 100 Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.

Lassen & Hjort, 52, Queen Victoria Street London, E.C.

Weighing Apparatus.

W. & T. Avery, Ltd., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., 100A, Midland Road, St. Pancras London, N.W.

Wind and Water Supply Machinery.

Eric S. A. Smith, Bridlington.

Wire Working Machinery.

Ed. Brand, 35, Shakespeare Street, Manchester.

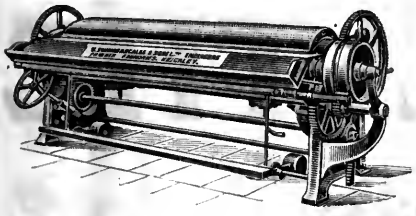
"Woodite."

"Woodite" Company, Mitcham, Surrey.

PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY — Machine Tools



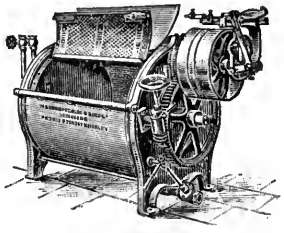
LAUNDRY MACHINERY

. AND . .

Cooking Apparatus.

CATALOGUE ON APPLICATION.

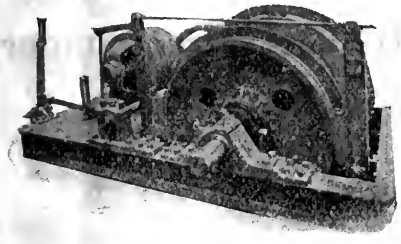
EXPERT ADVICE GIVEN.



W. Summerscales & Sons, Ltd.,

Phœnix Foundry, KEIGHLEY, ENGLAND.

Electric Hauling GEARS



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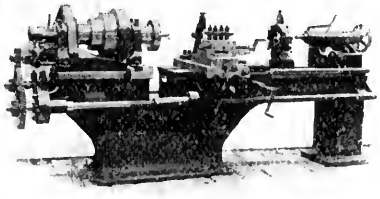

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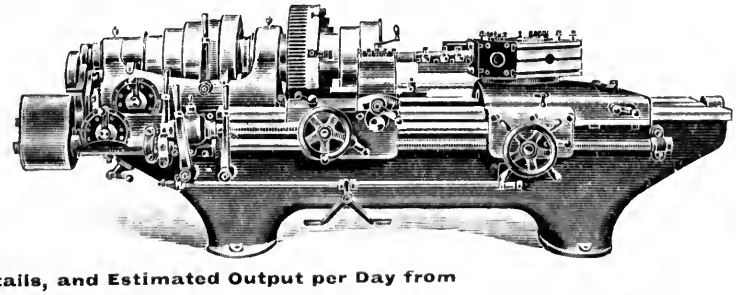

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PAGE'S WEEKLY

Machine Tools

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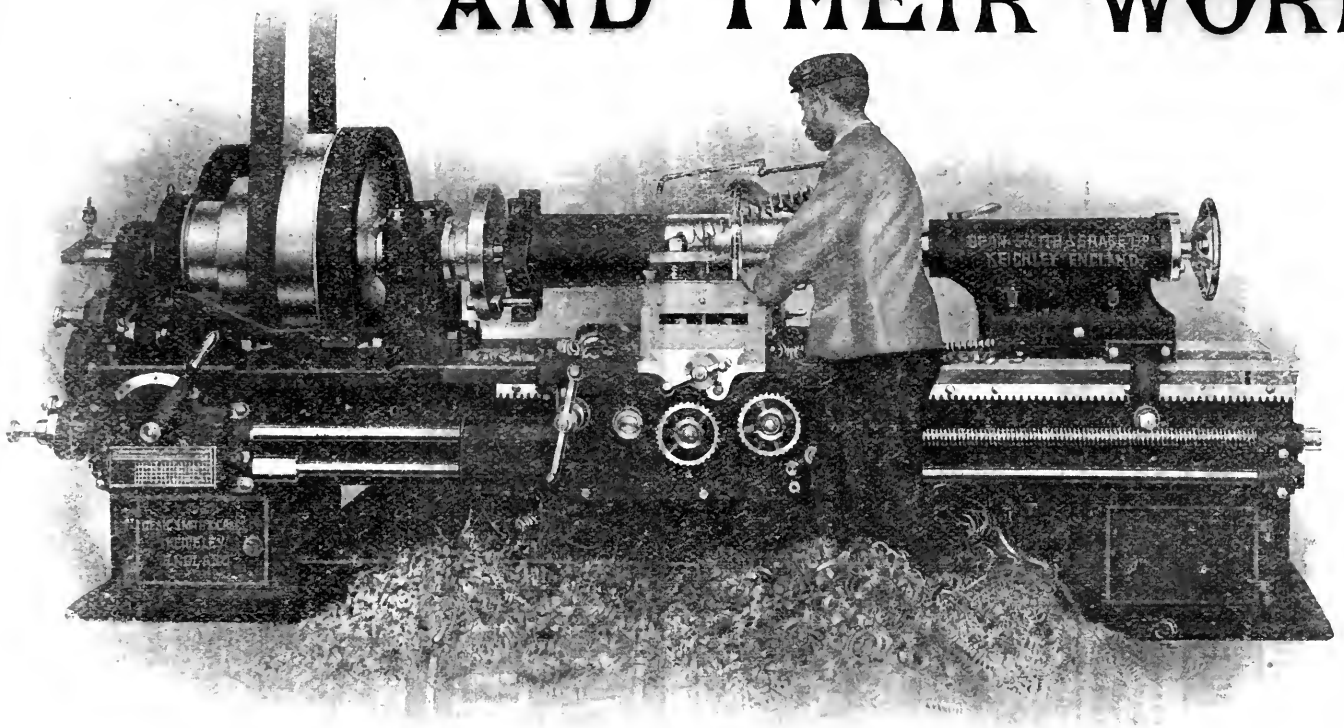

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PAGE'S WEEKLY

Machine Tools

Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

PAGE'S WEEKLY — Miscellaneous

Index to Advertisers—(Contd.)

PAGE'S WEEKLY

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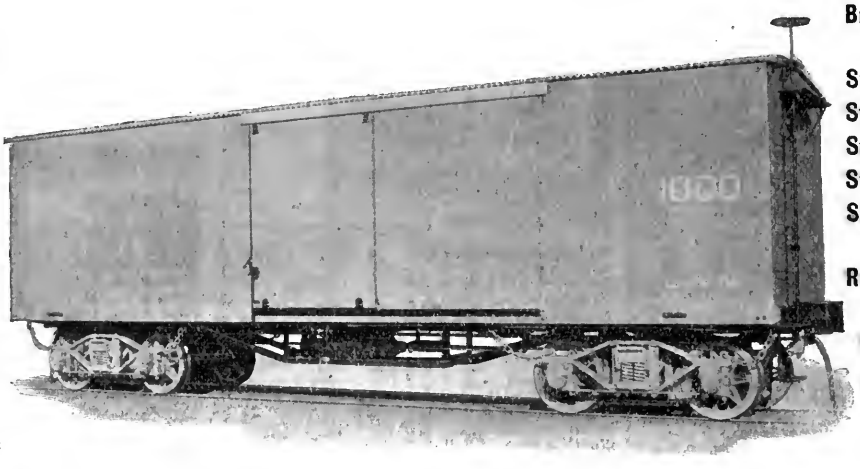

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VI. LONDON, FRIDAY, MAY 5, 1905. No 34.

The Offices of "Page's Weekly," Wednesday Evening.

THE exhibition opened at Liége in celebration of the seventy-fifth anniversary of the National Independence of Belgium, was, as is generally the case with these undertakings, by no means complete on the opening day. Nevertheless, it was obvious that the exhibition, covering an area of 170 acres, would be worthy of the country and the event. As might have been anticipated from the important position of Liége in the industrial world, the engineering section is one of the most prominent features, the largest exhibit being contributed by the Cockerill Company who are showing *inter alia* a 10,000-h.p. rolling mill engine. Although not officially represented, between forty and fifty exhibitors of English products figure in the exhibition. Among those in the Engineering Section are such prominent firms as Sir W. G. Armstrong, Whitworth and Co., who show machinery in motion; Messrs. W. and T. Avery, weighing machines; the Flexible Metallic Tubing Company; Messrs. Green and Son, fuel economisers; Messrs. Reavell and Co., of Ipswich, motors; and Messrs. Robinson and Son, of Rochdale, woodworking machinery. We hope to give further attention to the Exhibition in subsequent issues.

Of the engine house, which is over 35,000 square yards in extent, Belgium has taken 22,400 square yards, while Germany has appropriated 5,700; France 5,300: the United States 1,200, and British firms 700 square

THE HENRY CORT MEMORIAL TABLET.

yards. A prominent section is the gas producer plant and the engines driven by gas. There are two Vogt engines, embodying an entirely new application of gas power, and, according to a correspondent of the Glasgow Herald, the results promise to exceed in efficiency anything yet reached. Steam for the use of exhibitors is to be supplied at a pressure of 130 lb. per square inch; electric power will be charged for at 4d. per kilowatt hour; and power from the shafting 2½d. per horse-power per hour.

Henry Cort, one of the pioneers in iron bar production, was born at Lancaster in 1740. He began his experiments in 1765 and set up a forge and mill at Fontley, near Farnham, ten years later. He took out a patent for his puddling process in 1784, and expended a private fortune in developing inventions and building plants. His genius, however, failed to avert financial disaster, an unfortunate partnership contributing chiefly to his ruin, and he was glad to accept a small annuity from the Government. The illustration on page 943 shows the tablet unveiled to his memory at Hampstead Church. A replica has been executed for the parish church of Lancaster.

Although the inaugural meeting of the British Association in South Africa will not be held until August 15th, a good deal of thought has already been given to the matter by the Chemical, Metallurgical and Mining Society of South Africa, and other local bodies, in order that the members may "have full opportunity," to quote a Johannesburg gentleman, "of seeing the nakedness and fatness of the land." In Johannesburg, which will be looked forward to as one of the chief points of interest, some half-dozen sub-committees are engaged in making the necessary arrangements, and here the meeting will terminate on the afternoon of Friday, September 1st. For the benefit of those attending the South African meeting, it has been calculated that the minimum cost will be roughly between £1 10s. and £2 per diem, exclusive of purely personal expenditure and ocean passages. As regards the latter, reduced fares will be available by the Union Castle line for members and guests, particulars of which can be obtained from the secretary. The fares thus reduced for the passage from England to Natal and return from Cape Town vary between £65 2s. 4d., and £34 19s. 5d. The visit of the British Association to South Africa will coincide with the spring season of the Southern Hemisphere. Rain and humidity may be experienced in Cape Colony, and possibly in Durban; whilst on the high plateau, the prevailing dry season should ensure bright days and cold nights—the diurnal variations of temperature being of course very considerable. The president of the Engineering Section will be Colonel Sir C. Scott Moncrieff, G.S.C.I., K.C.M.G., R.E.; the vice-presidents being Professor T. Hudson Beare, B.Sc., M.Inst.C.E.; Mr. A. Siemens, M.Inst. C.E.; Mr. D. H. Hammersley-Heenan, M.Inst.C.E.; and Mr. S. Jennings, M.I.M.M. The secretaries are Mr. W. Bayley Marshall, M.Inst.C.E. (Recorder); Professor Henry Payne, Assoc.M.Inst.C.E.; and Mr. E. Williams, Assoc.M.Inst.C.E.

The second reading of the Aliens Bill marks another stage in a legislative proposal which, if placed upon the statute book, cannot fail to be of material benefit to the country. This old-standing grievance has lately been making itself felt with cumulative force (witness the figures we gave in a recent issue), and any measure which tends to relieve the obliging British taxpayer of what is becoming an intolerable burden, is a step in the right direction. As a writer in the Times aptly puts it: "The admission of foreigners, whether healthy or diseased, whether rich or poor, is an affair not of right, but of policy, and the policy ought always to regard the well-being of our own people, not the wishes

A TORPEDO EXPLOSION—FRENCH NAVAL OPERATIONS.

or the convenience of others. This Bill asserts our right, but in a most moderate way. It excludes only people whose presence is obviously and palpably injurious to the interests of our own population. It will admit a great many whom we could very well do without, and who, if not public nuisances, are, at any rate, of no public utility." Whatever may be their opinions upon the dumping of commodities, we think most Englishmen, and particularly Londoners, will be ready to join hands on the vital question of alien regulation.

Mr. John Gavey, the president-elect of the Institution of Electrical Engineers, is well known as the chief engineer of the Post Office. As a matter of fact, he has been associated with the telegraph department since it was taken over by the State in 1870, and has by successive promotions, arrived at the supreme position which an electrical engineer can occupy under that department. Mr. Gavey was a pioneer in the introduction of trunk telephony and has had not a little to do with the development of wireless telegraphy. He has long been a familiar figure at the Institution of Electrical Engineers, and we venture to predict that he will prove himself a capable and popular president.

Photo, C. B. Elliott and Fry.]

MR. JOHN GAVEY.

President-Elect of the Institution of Electrical Engineers.

At a recent meeting of the South African Association of Engineers, Mr. H. Leupold, manager of the Treasury Gold Mining Company, read a paper on tube mill practice, this being the first as yet presented covering actual experience on the Rand. We quote the following: The first run lasted from October 12th to November 22nd, when the tube mill was stopped, a few of the liner plates being worn in places to ½ in., though the majority still had a minimum thickness of 7⅛ in. These latter have since been found capable of giving another 12 days' work. The results of the first run were: Actual running time of the tube mill, 955 hours 45 mins.; weight of liners consumed, 3,115 lb.; weight of concentrates passed, 1,050 tons; weight of rock milled by battery, 10,750 tons; weight of pebbles consumed, 4,191 lb.; mercury used (deficit), 85 oz.; amalgam won, 575 oz.; fine gold won, 168 oz. The total working costs were £194 14s., or 3s. 8½d. per ton ground, or 4·35d. per ton milled. During the first run the usual 700 mesh screen remained in use most of the time, the grade and size of launders permitting only a tentative and partial application of 500 and 400 mesh. No appreciable increase in stamp duty was therefore attained, and the only advantage secured lay in the elimination of the rich concentrates' residue (2·13 dwts. average) and in the lower values of the sand and slime residues, which fell from 1·19 and 0·76 dwts. respectively in September to 1·10 and 0·61 respectively in October and November. This resulted altogether in a saving of 80 oz. fine gold on the 1,050 tons concentrates reground, and the 10,250 tons sand and slime treated during the run. The rattling and pattering of the loose pebbles against the liners should be heard most distinctly. At too low or too high a speed the pebbles form with the heavy pulp

a compact mass producing only a swishing sound, when the liners will be found to wear rapidly and the pebbles become flat discs, which are quite unsuited to do their proper work in the tube.

The second run, with new liners, lasted from January 1st to February 20th, a few worn-out liners being replaced by others, of the first run, on February 9th. On February 20th the whole of the liners were removed and a clean up made. The working costs were reduced to 3s. per ton of concentrates, equal to 3·29d. per ton milled. During this run the mortar screens were gradually changed to 300 mesh, the latter being in use exclusively since January 15th. This resulted in an increase of stamp duty from 4·8 to 5·2 tons per stamp per 24 hours, or 8 per cent. The provision of rock for the battery was deficient until the beginning of February, which caused irregular feeding, and it is expected that with full mill-bins in the future the duty will be 5·5 tons per stamp per 24 hours. The gain amounts to 194 oz. 11 dwts., or ·287 dwts. per ton milled —value, say 1s. 3d. These figures, says Mr. Leupold, are insufficient to warrant any far-reaching deductions, yet, on the whole, they may be considered promising for the tube mill.

A strong Committee has been formed for the purpose of organising a Representative and General Museum in Johannesburg, and an excellent nucleus for this has been made by the presentation of the whole collection of the Geological Society of South Africa, which now includes the collection of the Chamber of Mines. Independently of the permanent museum, it is intended to form a temporary exhibition on the occasion of the visit of the British Association to Johannesburg during the coming August. Professor J. Orr, Hon. Sec. of the Museum Committee (Box 3473), will be pleased to receive any communications on this subject from those interested.

Preliminary steps are being taken to commence the manufacture of iron in Natal for local consumption. A syndicate have applied for, and are reported to have obtained, a grant of land at Newcastle for the purpose. This town has been selected owing to the proximity to the coal mines. The nature of the company's operations will have no connection, at the present stage, with iron mining, the capital required for such an equipment being considered prohibitive during the present depression, but the intention is to purchase the iron scrap, which is furnished in such large quantities in South Africa by the rejection of worn-out iron material by the railways and public works departments of the various Colonies and municipalities, together with numerous other sources, and to convert it into new and saleable material, which shall be in price and quality capable of competing with the imported article. The principal aim in view is to supply the railways' demands for manufactured iron and steel, and with this object it is proposed to lay in a full equipment of plant capable of producing steel rails, bolts, rivets, plates, bar-iron, and all the diversified constructional iron work which a railway and general contractor needs.

The improved economiser shown at Liége, by Messrs. E. Green and Son, Ltd., contains 72 heating tubes (equal to about 750 square feet of heating surface). It is of the high-pressure type, the top boxes being fitted with internal lids, tapered the reverse way of the socket in the box. The scraper gearing is actuated by a one-horse power motor. A small horizontal steam engine on the gearing frame as an alternative method of driving the scraper gear is also shown. On the stand itself figure specimen castings of top and bottom boxes, together with one of the economiser pipes burst at the pressure of about 4,000 lb. to the square inch.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No: 3349 GERRARD.
Telegraphic and Cable Address: "SINEWY, LONDON."

Correspondence *is invited from any person upon subjects of interest to the engineering community. In all cases this must be accompanied by full name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

The Editor does not hold himself responsible for the opinions expressed by individual contributors, nor does he necessarily identify himself with their views.

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New Copy for Advertisements,

Alterations, &c., intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, MAY 5.—Junior Institution of Engineers, Westminster Palace Hotel, 7 p.m.: Papers, "The Influence of Depth of Water on Speed of Vessels," Mr. Leslie C. Lambert; "Condensing Plant," Mr. James N. Boot.—Royal Institution, Albemarle Street, 9 p.m.

SATURDAY, MAY 6.—Birmingham Association of Mechanical Engineers: Half-yearly Meeting.

MONDAY, MAY 8.—Society of Arts, Cantor Lecture, 8 p.m.

TUESDAY, MAY 9.—Royal Colonial Institute, Whitehall Rooms.—Institution of Electrical Engineers (Glasgow Local Section).

WEDNESDAY, MAY 10. — Institution of Electrical Engineers, (Birmingham Local Section).—Geological Society.—Institution of Mining and Metallurgy, Annual Dinner at Hotel Cecil

THURSDAY, MAY 11. — Institution of Mechanical Engineers: Conversazione.

NEWS ITEMS.

It is stated that the Krupp Company have bought land on the island of Alsen, Schleswig-Holstein, with the object of establishing a large shipbuilding yard there.

It is anticipated that the Cape to Cairo Railway will shortly reach Kalomo, 100 miles north of Victoria Falls. The new bridge over the Falls will probably be opened for railway traffic early in June.

It is estimated that 60,000 civilian Japanese have already passed into Korea. Railway construction is being rapidly carried on and railway communication is practically complete between Fusan and the Yalu.

The iron and steel market has been characterised by the efforts made to maintain the price of Middlesbrough, at all events for near dates, and at one time the "squeeze" put the price up to 52s. per ton.

During 1904 the production of wolfram ore in North Queensland amounted to no less than 1,539 tons valued at £161,635, as compared with 197 tons valued at £7,870 in 1903. A marked stimulus has been given to the industry by the demands of European steel makers.

At the annual meeting of the City of Birmingham Tramways it was mentioned that 54,000,000 passengers had been carried during the year. The chairman mentioned that though they were of opinion motor omnibuses could not compete with tramways, they were testing their merits as against horse omnibuses.

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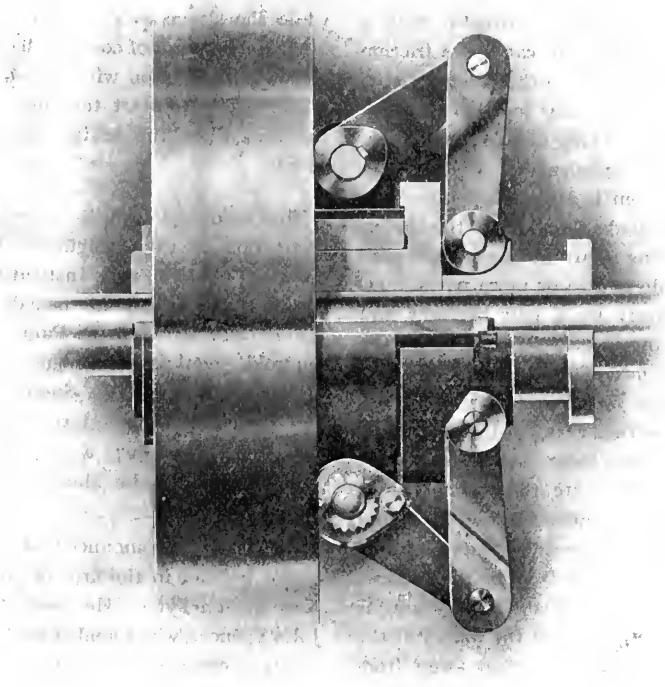


PART SECTION, SHOWING FRICTIONAL CLUTCH AND PULLEY IN GEAR.

The Torpedo as an Instrument of War.

At a meeting of the Leeds Association of Engineers, held on April 27th, the President (Mr. W. H. Drake) occupying the chair, a discussion on the subject of "Torpedoes" was opened by Mr. James Topham, who described the construction of a modern 18-in. torpedo. The whole machine, he said, weighed 1,158 lb., the war-head, of hard phosphor bronze, containing about 200 lb. of gun cotton. Torpedoes could be set, by means of the hydrostatic valve, to run just below the surface or 24 ft. deep. For practice, they were usually tried at a depth of 8ft. to 10 ft.; he had seen hundreds fired, but none had deviated more than 6 in. from the horizontal. This accuracy was due to the governing action of the pendulum weight, connected with the lateral fins. In practice firing, torpedoes were set to run for 200, 400, or 600 yards, when they came to the surface, but in warfare, if they failed to hit, after having run their course, they should sink to the bottom. The mechanism for actuating the impeller was so delicate that some portions were made to a quarter of a thousandth of an inch. It was, however, the gyroscope, placed abaft the "engine room," and which, being connected with the vertical fin, prevented the inevitable tendency to travel in a curve, that had made the torpedo effective at ranges from 800 to 3,000 yards. It was now one of the most reliable weapons in the service. The gyroscope had, however, only been in operation two or three years, and its use demanded long experience; hence the incomplete success of the Japanese practice. With regard to torpedo nets, there was a secret known to the British Navy (amongst others) by which a torpedo could be made to penetrate any net of any other navy, but no other navy had shears which could cut through our nets.

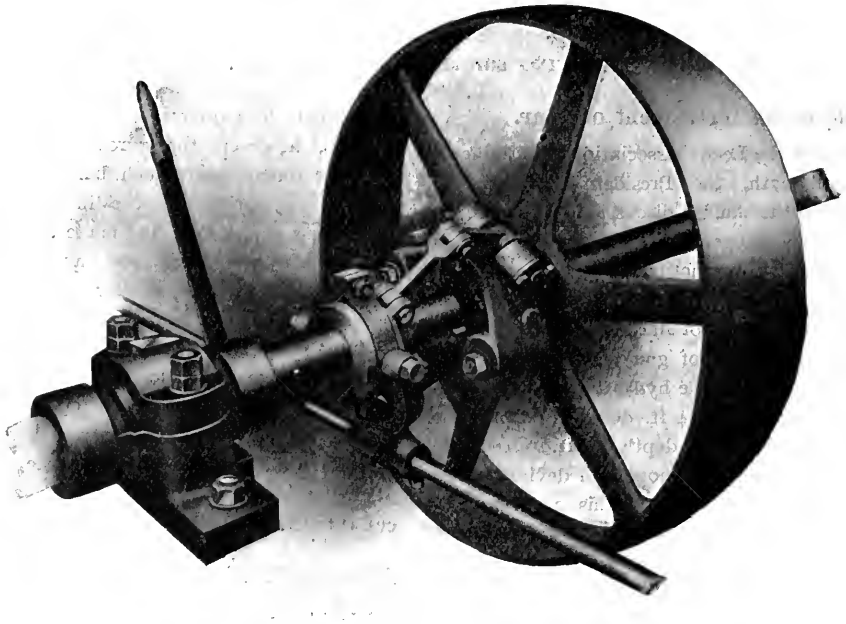
A Patent Frictional Clutch and Shaft Coupling.

We illustrate by courtesy of Messrs. Mather and Platt, Ltd., a multiple form of clutch, by the use of which loose pulleys can be dispensed with. Besides its use for driving ordinary machinery, this form of

clutch is specially applicable to hauling machines for mines and collieries. It is shown below in connection with an ordinary belt pulley. The clutch comprises a friction boss on the pulley, a fixed sleeve on the shaft, and the friction band. The sleeve provided with a flange, and of a length sufficient to carry the friction boss and the pulley, is keyed on to the driving shaft. It is desirable to use a special key for this purpose, provided with a gib-head carrying a set screw; such an arrangement is very convenient for withdrawing the key when there is no room to get at the point. The friction band which surrounds the boss of the pulley is carried from the driving shaft through the flange of the sleeve, and is made in two or more parts, connected together respectively by a pair of right and left handed screws working in two sets of ears on the parts of the friction band. To the right and left handed screws are rigidly fixed arms, connected by links to the loose sleeve, worked by an ordinary shifting fork and lever. When the loose sleeve is pushed towards the clutch, the arms are thrown out away from the shaft; by this movement the two right and left handed screws are turned in their nuts so as to tighten the friction band on the boss of the pulley; the latter is then driven since the friction band is secured to the driving shaft through the flange of the sleeve. When the loose sleeve is pushed away from the clutch the friction band is loosened, and then runs free of the boss on the pulley. By a slight modification the clutch arrangement previously described can be converted into a shaft coupling. In this case the friction boss, instead of being attached to the pulley, is arranged to slide on a feather key on the one shaft, while the sleeve carrying the bands is keyed to the other. This form of coupling has been found especially useful in connection with gas engines, as by its means it is possible to start the engine light, and throw on the load when the engine has run up to its normal speed.

The following awards have been made by the Institution of Civil Engineers for papers read and discussed before the Institution during the past session: Telford gold medals to Lord Brassey, K.C.B., and Mr. C. S. R. Palmer; a George Stephenson gold medal to Mr. Lyonel E. Clark; a Watt gold medal to Mr. J. F. C. Snell; Telford premiums to Messrs. L. F. Vernon-Harcourt, M.A., R. W. Allen, and Wm. Marriott; a Crampton prize to Mr. A. Wood-Hill, and the Manby premium to Mr. E. D. Pain.

The death is announced of Mr. John Spencer, the senior partner in the firm of John Spencer and Sons, Newburn-on-Tyne. He was the eldest son of Mr. John Spencer, who founded the steel works at Newburn nearly a century ago. Among the recent developments was the putting down of large mills for the manufacture of ship and boiler plates.



FRICTIONAL CLUTCH AND PULLEY OUT OF GEAR.

ELECTRIFICATION OF RAILWAYS.

By H. W. WILSON.

IT is obvious, from the nature of things, that the suburban lines present the easier problem from the electrification point of view, and will derive the greatest advantage from such conversion. The electrification of main-trunk railways is in a state of scientific discussion, and little actual work has been done up to the present time.

The direct-current system of supply, with either plain direct current generation or conversion from alternating currents, has, until recently, been regarded as the only satisfactory method of operation, and some large schemes have been carried out with various arrangements of direct current apparatus. The main reason for this has been the admirable features from a traction point of view of the series direct-current motor, which has been developed, both in itself and in the methods of control adopted, into one of the most perfect arrangements of apparatus conceivable.

In this motor the torque developed decreases with increase of speed, and inversely with increase of load the speed of the motor decreases. The maximum torque of such a motor occurs in starting. The best makes of direct-current traction motors will stand tremendous overloads without serious sparking, and their operation is simple and easily learned.

For the operations of main lines, in order to avoid heavy transmission losses or impossible capital expenditure, it is necessary to use extra high tension generation, with transformation at sub-stations along the line. If the sub-stations are to contain converting machinery with the necessary skilled attendance, they must be kept as few as possible, although this means increased transmission losses on account of the greater length of feeders. It will, therefore, obviously be more satisfactory to use sub-stations simply containing ordinary transformers.

In view of the fact that the capital and running cost of converter sub-stations renders their use impossible, it is apparent that the use of alternating current with comparatively high voltage supply to the trains is essential.

SINGLE-PHASE ALTERNATING-CURRENT SYSTEM.

The foregoing consideration makes it apparent that the use of overhead conductors for the supply of energy is necessary, and it is clear at once that we are compelled to consider either the single-phase or the polyphase alternating current systems of railway working. The inherent defects of the polyphase system, from a railway engineer's point of view, practically puts this out of court. In spite of the ingenuity and resource of the engineers who have directed their attention to overcoming the difficulties of three-phase railway working, it is still impossible to get as satisfactory results from any combination of three-phase motors as can be obtained from the direct current system and series parallel control. Even were this not so, the complications caused by the necessity of using at least two overhead conductors completely bars the system from a practical point of view on a crowded railway. We are, therefore, at once driven to the consideration of the single-phase equipment.

It seems reasonable to assume that one or other of the repulsion type of motors is the one that will be more generally used, and concerning these machines it may be said that the motors have the same characteristics as the direct current series motor, namely, maximum torque at starting, decrease in torque with decrease in current and increase in speed and comparatively constant efficiency through a wide range of speed. The power factor of the repulsion motor rises very rapidly with the speed; it reaches a good value at one-third synchronous

	Direct Current System	Alternating Current System
POWER HOUSE—		
Buildings	£2,000	£2,000
Foundations	500	500
Boilers and Settings	2,400	2,400
Steam Piping and Covering	1,500	1,500
Engines	4,400	4,400
Generators, two 400 K.W.	3,600	4,600
Exciters	200	200
Step-up Transformers, 800 K.W.	1,600	1,500
Switchboard	700	600
Wiring	600	500
Feed-water Heater	160	160
Pumps	160	160
Coal Storage	200	200
Smoke Stack and Flues	400	400
Fuel Economisers	600	600
Stokers	700	700
Incidentals	880	880
Totals	£20,600	£21,300
SUB-STATION IN POWER HOUSE—		
Building Extension	£200	£120
Synchronous Converter, 300 K.W.	960	—
Transformer, 300 K.W. Alternating Current	640	400
Switchboard	400	260
Wiring	200	100
Incidentals	120	40
Totals	£2,520	£920
48-MILE TRANSMISSION LINE—		
Poles charged to Trolley Line	—	—
Copper	£2,000	£2,300
Insulators, Pine and Cross-Arms	1,500	1,000
Erection	800	600
Incidentals	200	200
Totals	£4,500	£4,100
SUB-STATION ALONG THE ROAD—		
Building	£400	£200
Synchronous Converter	960	—
Step-down Transformers	640	400
Switchboard	400	260
Wiring	200	100
Incidentals	100	40
Totals	£2,700	£1,000
Four Sub-Stations	£10,800	£4,000

	Direct Current System	Alternating Current System
TROLLEY LINE AND FEEDERS—		
Poles, 3,500	£3,500	£3,500
Erection of Poles	800	800
Guides and Anchors	400	400
Brackets, with Hangers	3,600	5,000
Copper, Direct Current—		
Feeder, 12 miles, 500,000 cir. mils.	—	—
" 48 miles No. 0000	—	—
Trolley, 120 miles No. 000	19,000	—
Alternating Current—		
Trolley, 60 miles No. 00	—	4,300
Feeder Insulators	400	—
Erection	2,000	800
Incidentals	1,500	800
Totals	£31,200	£15,600
BONDING OF RAILS—		
Both Rails Bonded	£6,000	—
One Rail Bonded	—	£3,000
Cross Bonds	400	200
Totals	£6,400	£3,200
ROLLING STOCK—		
Ten Vestibule Passenger Cars, weighing about 30 tons, with four Motor equipments	£15,000	£17,000
Two Express Passenger Cars, weighing about 35 tons, with four Motor equipments	3,600	4,100
Two Luggage Cars, 30 tons weight, with four Motor equipments	2,000	2,400
Snow Plough and Repair Car	1,400	1,700
Totals	£22,000	£25,200
RECAPITULATION—		
Power House	£20,600	£21,300
Sub-Station in the Power House	2,520	920
Transmission Line	4,500	4,100
Four Sub-Stations along the Road	10,800	4,000
Trolley Line and Feeders	31,200	15,600
Bonding of Rails	6,400	3,200
Rolling Stock	22,000	25,200
Totals	£98,020	£74,320
Cost per Mile	£1,633	£1,238
Saving per Mile	—	£395
Approximate saving = 25 per cent.		

COMPARISON OF COST OF DIRECT AND ALTERNATING CURRENT SYSTEMS.

speed, and values of nearly 90 per cent. are obtained over a considerable range of speed. For this reason a large number of poles are not necessary, and frequencies up to even 60 cycles may be employed.

The motor efficiency, while not so good as the direct-current motor efficiency, is satisfactory, reaching values of 80 to 85 per cent., including gear losses, for motors ranging from 50 to 200 h.p. At normal speeds, commutation is very good, due to the revolving field.

A COMPARISON OF COST OF SYSTEMS.

From the above particulars briefly given it is apparent that the single-phase traction motor has now reached a degree of saitisfactory performance which brings it within the range of praticable use for railway work, and that being granted, it will be advisable to consider the probable comparative costs of equipment as compared with the standard direct current system. Various provisional estimates have been drawn up in America giving these comparative figures, and in a calculation which was given by Mr. Blanck before the American Institution of Electrical Engineers in an article on Single-Phase Railways he prepared some figures which are given in the table on page 952.

The more favourable capital cost shown with the alternating current system is due almost entirely to the great reduction in the substation costs and the reduction in the weight of copper in the trolley line. It has been assumed that the alternating-current motor equipments will cost one-third more than the direct current, which is a very liberal allowance. It was assumed in making these calculations that the line was 60 miles long, single track, between towns; that there were five local cars having a one-hour headway and running at 25 miles per hour and taking 144 units for the run; one express car making the round trip in three hours and having a schedule speed of 42·8 miles per hour and taking 231 units.

RETURN DROP OF VOLTAGE IN RAILS.

A point which does not always receive the attention which it merits in considering questions of railway electrification, but which is really a governing factor of the possibility of such a scheme, is the consideration of the return drop of voltage in the rails under working conditions. With a direct-current equipment, a very large increase of line voltage will be difficult on account of troubles with commutation. With an alternating-current system this difficulty does not occur, and the line voltage could be raised very considerably. A further difficulty, however, now crops up, which is, that the apparent resistance of the rail track with alternating current is very considerably greater than the actual ohmic resistance, on account of the fact that the current density is not the same over the whole area of the rail, but is much greater on the outside portion. This skin effect when the cross sectional area of the rail is large becomes a very serious factor, and in an iron rail is further complicated by the varying magnetisation set up by the alternating current. It is obvious that this impedance effect will vary with the periodicity, and the lower the periodicity the lower will the apparent resistance of the track become, but the exact degree of this variation for different current densities has not been very carefully worked out yet.

It seems probable, however, that as alternating-current systems develop the present practice of bonding the steel track and using it as the return conductor may be done away with, and instead an insulated copper conductor earthed at one point and led along the track will be used as the return. For an alternating-current system of comparatively high voltage, and certainly anything like a high periodicity, the capital cost of using an insulated copper return conductor will be less than that of going to the expense of bonding all the track, as would otherwise have to be done. The much lower value of the self induction of copper than of iron would enable a comparatively small section conductor to be used. From the above considerations it is apparent that a low periodicity is of advantage for railway working with the exception of the one point of train lighting.

INSULATED RAILS VERSUS OVERHEAD CONDUCTORS.

The writer is of opinion that if the electrification of anything more than suburban rrailways is to be undertaken high transmission and supply voltage is essential, necessitating inevitably the use of a single phase alternating current system. This being admitted, it is obvious that the supply current through an insulated rail, either between the running tracks or in the 6 ft. way, is out of the question. It is quite open for a railway engineer to argue that, on account of the physical difficulties in the way of high voltage overhead conductors, they are also impossible in existing main line railways. The writer fully admits the fairness of these objections. Notwithstanding this, however, more difficult engineering problems than the arrangement of an overhead conductor, even for the worst places of the ordinary running track, have been overcome.

Abstract of paper read before the Liverpool Engineering Society.

TECHNICAL SOCIETY NOTES.

THE discussion at the Institution of Electrical Engineers on Thursday last on the seres motor as applied to traction dealt with a very live subject. Mr. B. J. Arnold touched upon it in his presidential address to the joint meeting at St. Louis last year, when Dr. Steinmetz read a paper on different systems of using alternating current in electric railway motors, and a paper was recently read before our Institution by Mr. Creedy on the alternating current series motor. A good many opinions were elicited in the course of the discussion, and if they were to a certain extent conflicting, this is not altogether surprising. This at least is obvious that the supply of alternating current in some form or other is essential for practical railway traction.

Mr. H. A. Wilson, in a paper recently read before the Liverpool Engineering Society, appears to favour the repulsion type of motor as likely to be generally used. He points out that the power factor rises very rapidly with the speed so that these motors have many of the same characteristics of the direct-current series motor. Mr. Creedy on the other hand claims a superiority for the series motor over other single-phase motors, such as the repulsion motor, in which he points out that it is very difficult to secure a good power factor concurrently with good efficiency. Professor Carus-Wilson declares that the power factor with an alternating-current series motor can be anything desired, but that what has to be considered is whether such a motor designed for a high power factor is a good form of motor for railway work. However, the discussion came very much to this, that those who had practical experience of the alternating-current series motor are favourably impressed with its possibilities for railway work.

Westphalia has of late made great strides in the application of electricity for mining purposes, and in this connection the paper read by Mr. E. O. Forster Brown before the Mining Institute of Scotland may be noted. In Westphalia boiler coal is of much greater value than in Silesia, so that any saving of power is an important economy. The system of current used for general purposes in the newer plants is with rare exceptions three-phase. The chief advantages claimed for this system over continuous current are that three-phase machinery is cheaper to construct; admits of being generated and transmitted at a high voltage at a relatively smaller cable cost; can be transformed to any suitable working voltage in the neighbourhood of the motor, while the absence of a commutator considerably simplified the working. The voltage used is usually 2,000 or 3,000 volts and sometimes 5,000 volts, and in the majority of cases it is transformed down to 200 or 300 volts.

The purposes to which electricity have been chiefly applied are pumping, ventilating winding, haulage, coal-cutting and air-compressing. A large variety of electrically driven pumps are employed and the pump of the future appears to be of centrifugal type, which appears to give excellent results for sinking purposes.

The author points out that until electric winding engines of large size have been conclusively proved to be as reliable and efficient as steam engines, and at the same time show a substantial saving in fuel and upkeep, sufficient to repay the original capital outlay, electrical power is not likely to be applied to a large extent at individual collieries not troubled with water, where the winding engines consume the largest proportion of power required for working the colliery.

SOLID FORGED AND ROLLED STEEL WHEELS.

A NEW DEVELOPMENT IN CONSTRUCTION.

BY SAMUEL M. VAUCLAIN, Superintendent of Baldwin Locomotive Works.

THE requirements for car wheels under heavy freight and similar equipment have increased rapidly during the last few years, and cast-iron wheels, which at one time proved satisfactory, are under present conditions taxed beyond their limit of economy. Axle loads have increased fifty to one hundred per cent., whilst it has been impossible to increase proportionately the weight of the wheels. With this increase of load have come also higher speeds, adding largely to the stresses borne by the wheels.

The chilled cast-iron wheel has long been in use. It is distinctively an American product. Within certain limits the manufacturers have been successful in meeting the demands made upon them. By careful design, by the selection of the best material, and by improved moulds and methods of casting, the makers have been able to accomplish much. Nevertheless the brittleness of the flange, the inability to resist the heating effect caused by the application of the brake shoe, and defects liable to develop in the composition, inducing unequal internal stresses and causing shelly treads are not wholly overcome. It is therefore evident that something more substantial than the chilled cast-iron wheel must be used to withstand these difficult requirements. It may be added that the conditions under which electric truck wheels are operated are quite different from those which apply to the ordinary truck wheels under passenger and freight cars. In the case of the latter the weight of the car and truck is spring-supported, thus avoiding to some degree the severe shocks upon the wheels. In an electric truck, however, the wheels sustain in addition to the weight of the car that of the heavy electric motors, the larger part of which is necessarily unsupported by springs, and is borne rigidly by the axle and wheel.

BUILT-UP WHEELS.

The ideal wheel should be unbreakable in any part, free from defects incident to manufacture and with wearing surfaces dense, solid and of proper hardness to resist rapid wear. This demand has been largely

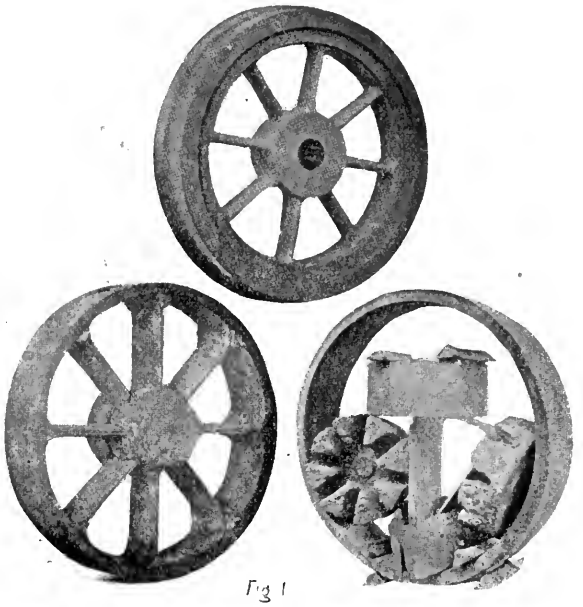


Fig 1

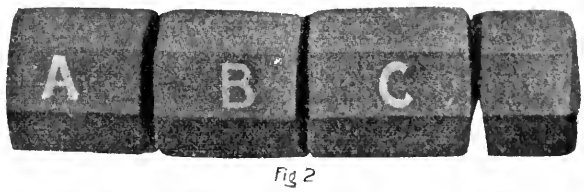


Fig 2

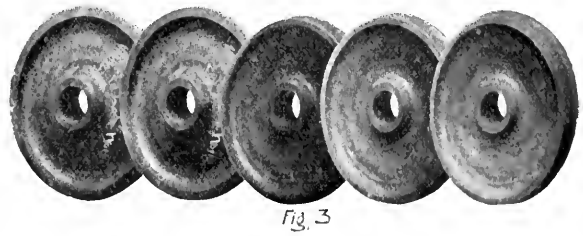


Fig 3

FIG. 1. THREE STAGES OF MAKING A WROUGHT-IRON SPOKE CENTRE STEEL-TIRED WHEEL. FIG. 2. BLOOM FROM WHICH ROLLED WHEELS ARE MADE. FIG. 3. ROLLED STEEL WHEELS.

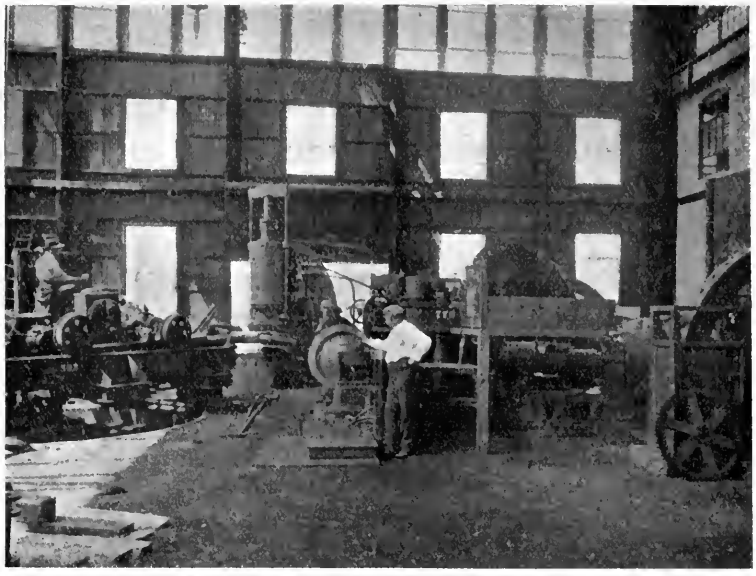


FIG. 4. VIEW OF ROLLING MACHINE.

met with by the introduction of the various types of built-up wheels, having tires secured to separate centres of wrought iron, cast steel, or cast iron, and of either spoke or plate pattern.

The Standard Steel Works have for many years furnished a product of this description which has met the most rigorous specifications. Fig. 1 represents three stages of the process of making wrought-iron spoke centre steel-tired wheels. The spokes are made by bending pieces of iron of rectangular section into the form of a triangle. These are fitted into a ring forming the periphery of the wheel. Hub pieces are then placed in the centre binding together the free end of the spokes. The whole mass is then heated and hammered under dies until the parts are welded together, after which it is machined and receives the tire.

In the process of manufacture of wheels having separate tires the item of labour is considerable, which together with the greater cost of material, makes them more expensive than cast-iron wheels. Notwithstanding their greater cost the necessity of providing absolute safety has led to their extensive use in passenger service, but they have been practically excluded from freight service.

A NEW SOLID FORGED AND ROLLED STEEL WHEEL.

The Standard Steel Works have succeeded in perfecting the solid forged and rolled steel wheel, which meets every requisite of safely, and which is cheap enough to prove economical in all kinds of service.

In the manufacture of this new wheel, the whole wheel is forged as thoroughly as a tire bloom, and is subsequently rolled to the required form and size. Owing to the high strength of the steel the wheels can be designed with lighter hubs and webs than could be made from cast iron, thus reducing the weight of these parts and making it possible to thicken the rim in a wheel of equivalent total weight. The rolled wheel is for the same reason lighter than an equivalent steel-tired wheel built up with separate centre and steel tire. The steel used in the manufacture of these wheels is made from the open-hearth process, of composition similar to that used for steel tires of medium grade of hardness, that is to say from ·65 to ·70 carbon. The method of manufacture tends to increase the density of the metal, giving wearing qualities fully equal to that of steel tires of the same chemical composition.

Great care is taken in the selection of the billets. To insure a perfectly homogeneous metal free from structural defects, only the bottom sections are used, whilst the top section containing imperfections is discarded.

The ingot is cut into sections as shown in fig. 2. The portions marked A, B, and C are made of sufficient weight to form a wheel, the unlettered end being the segregated portion which is not used.

The process of handling the ingots is effected by means of an electric manipulator. From four to six billets are cut from each ingot. The billets are then forged, under a 5,000-ton hydraulic press, into blanks of suitable shape to be rolled into wheels, these blanks being handled by mechanical means. From this press by means of an overhead crane, the blank is transferred to a specially designed rolling mill, by which it is subjected to great pressure simultaneously with the rolling process. The rolling process is thorough, covering the web, rim and tread of the wheel. After the rolling process is completed, the curve in the web is formed by placing the wheel in a 500-ton hydraulic

press, which gives it the desired shape. This press is shown in fig. 4, as is also the rolling machine.

TESTS.

Fig. 5 represents three thin radial sections taken from a forged wheel to show the quality and strength of the material under bending and torsional tests. These tests were made cold, the pieces receiving no treatment whatever after being cut from the wheel, and the wheel itself was not subjected to any heat treatment after being rolled.

Many chemical tests have been made of these wheels which show homogenous metal, uniform in the characteristics of the steel in the whole of the wheel.

Tests have also been made by supporting the wheels horizontally upon a ring underneath the face of the tread and allowing a weight of 2,240 lb. to strike the wheel from various heights. It took thirteen blows to break a 36 in. wheel, eight of the blows being from a height of 30 ft.

Another wheel was tested in running position being struck by a weight of 2,240 lb. It took seventeen blows, nine of which were from a height of 25 ft., to fracture the wheel from rim to hub.

Fig. 6 represents the wheel after it had been subjected to this severe test, and clearly shows the ability of such a wheel to resist any stress which it would be liable to encounter in actual service.

One of the severest tests than can be imposed upon chilled cast-iron wheels is that which is generally known as the "Thermal Test." This consists of pouring a ring of molten iron 1½ in. thick and 4 in. deep against the tread, no cracks to develop within two minutes. This test is designed to show the ability of the wheel to withstand without injury the heat generated by the application of the brake shoes. A number of rolled wheels have been subjected to this test without injury. The heat from a ring of metal 4 in. thick in place of 1½ had no further effect than to cause the rim to expand and straighten out the web slightly. No fracture was produced, and the heat given off by the molten metal was sufficient to heat the tread for 2 or 3 in. to a dull cherry. This proves that no injury to the wheel could result from the application of the brakes.

FIELD FOR THE NEW WHEEL.

The natural field for the rolled wheel is:—

(1) The severe service of engine and tender trucks, in which steel-tired wheels are exclusively used.

(2) Passenger car equipment, in which safety constitutes an imperative consideration.

(3) Heavy freight car equipment, for which the chilled wheel has proved inadequate.

The wheels, however, are adaptable to lighter service, and are profitably employed in street-car service.

Fig. 3 shows a group of solid forged and rolled wheels for railroad service. In the construction of these wheels lightness and strength are combined to remarkable degree. The pressure from the hydraulic press used in forming the blank gives great density to the steel, whilst the pressure again given it in the rolls, together with the rolling process itself, insures the finest possible structure.

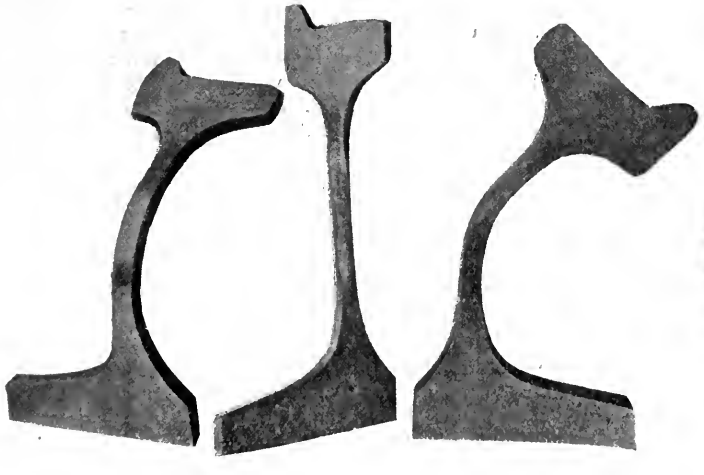
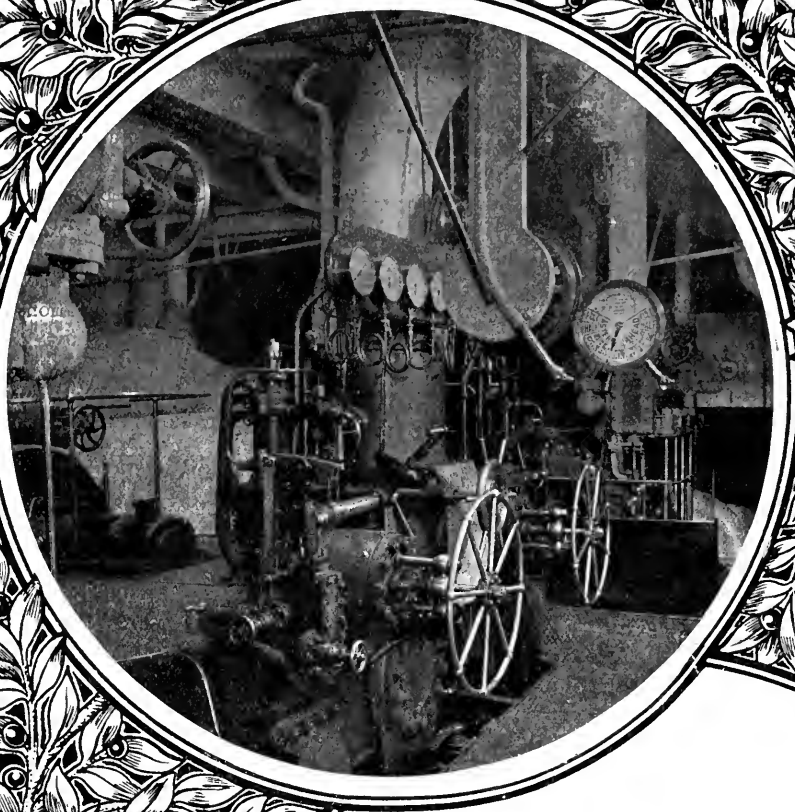


FIG. 5. RADIAL SECTIONS FOR TESTING THE FORGED WHEELS.

FIG. 6. APPEARANCE OF WHEEL AFTER DROP TEST.



RECENT TURBINE INSTALLATIONS— X.

STARTING-GEAR OF THE STEAMER "LUNKA."

This illustration shows the starting-gear in connection with one of the latest Parsons marine turbine installations by Messrs. Denny and Co., of Dumbarton. The two large prominent wheels are those for manœuvring the urbines in port, by means of which one turbine can be going ahead and the other going astern. The smaller wheel between these two large ones gives steam to all three turbines, and is used when the ship is going full speed ahead.

It will be noticed that the two telegraphs which communicate the orders from the bridge are above the large wheels and so placed that the engineer standing between them, and having control of the machinery, can easily read either. In front of the engineer all the gauges are arranged, and it is by the use of these that the engineer is able to ascertain what speed is being attained, and if the turbines are working properly.

The turbines themselves being enclosed they cannot be observed by the engineer in the same way as the old-fashioned engines, and he is dependent on the reading of the gauges for all information.

NAVAL NOTES.

GREAT BRITAIN.

The "scare" occasioned by an irresponsible writer as to the alleged inefficiency of the 12-in. guns carried by the *Majestic* and *Canopus* class of battleships, was probably not very acute among thinking men. The writer chronicled the "discovery" that the 35-calibre, 12-in., Mark VIII. wire-gun, which constitutes the main armament of 15 out of 37 of our newest and most powerful battleships, is incapable of firing fifty full charges, and also that the latest Woolwich pattern 6-in., 50 calibre wire-gun has also failed under experiment. The Admiralty on Thursday issued the following statement: One 12-in. Mark VIII. gun cracked its muzzle on board the *Majestic*, and a second gun showed signs of a crack in the inner tube. They had fired the equivalent of sixty-six and seventy-five full charges respectively, and on examination the steel of the inner tubes was found to be soft, and this was the probable cause of the weakness. The two guns were exchanged, are being repaired, and will be shortly re-issued.

With reference to the statements which have been published, it is sufficient to quote the fact that the first 12-in. Mark VIII. gun fired 162 full charges before being re-lined. The guns now afloat that have fired the greatest number of rounds are on board the *Mars*, *Cæsar*, and *Jupiter*. These have fired the equivalent of over sixty full charges, are still perfectly serviceable.

So much for the "scare." It is very difficult to see what advantage is gained from these sensational reports. The promptly-issued statement of the Admiralty leaves no room for doubt in the minds of the public as to the efficiency of our fleet, but such "scares" are far from complimentary to Sir John Fisher and his naval colleagues, and it certainly cannot be said that they enhance the dignity of the press.

GERMANY.

The battleship *Elsass* on trial recently attained a speed of 18·74 knots with an indicated horse-power totalling 16,812.

The small cruiser *Leipzig* (N) was launched at Bremen on March 22nd.

HOLLAND.

The torpedo-boat destroyers G1 and G2, of whose launching mention has already been made in these notes, have completed their trials. The torpedo-boats K1, K2, and K3 have received the names *Michel Cardijn*, *Christaan Cornelis*, and *Willem Warmont* respectively.

NEWS ITEMS.

"The Society of Post Office Engineers" is the title of the latest technical society. The society has elected the following officers: President, Mr. D. H. Kennedy, A.M.I.E.E., London; vice-president, Mr. P. Jarvis, Sunderland; treasurer, Mr. J. M. Crawford, London; secretary, Mr. J. W. Atkinson, 45, Arbuthnot Road, New Cross, London, S.E.

At the sixteenth annual meeting of the Institute of Marine Engineers, the annual report showed that seventy-five new members, inclusive of all grades, had been elected, thus bringing up the number of active members on the register to 928. A satisfactory account was given of the year's work, and the accounts showed a balance on the credit side of £225 18s. 10d. It was stated that a good deal of thought and attention had been given by the council to the question of centres, and as a result a set of rules and regulations for the conduct of the centres had been drawn up, and was submitted for modification and approval. Sir Marcus Samuel was appointed president, Mr. James Adamson hon. secretary, and Mr. James Blake treasurer.

It is not generally known how gigantic are the operations which are now going forward at Niagara in connection with the equipment of the new stations on the Canadian side. For example, the station of the Ontario Power Company is supplied with water through a steel pipe which measures no less than 18 ft. in diadiameter, and the water it alone can convey will develop 63,000 h.p. Anyone who has had to do with the laying of pipes will appreciate the immense difficulty there has been in laying so large a pipe in a straight line, also arranging for all the joints to remain tight, for when the pipe is filled with water the weight on the foundations is enormous.

The power station itself is at the bottom of the Fall, but the machinery is controlled from a station at the top of the Fall, and some 200 yards away from the machines. The synchronising of the machines and cutting in and out, etc., will thus be effected by a man who is not able to see the plant. Parallel running, however, is easy when the prime movers are driven by water power, and where, therefore, the rotative effort is a constant one. The generators will develop three-phase current, which is to be stepped up to 60,000 volts in the first instance, but afterwards it is hoped to work at 80,000 volts, and transmit the power to Cleveland and Detroit.

AN AIR COMPRESSOR FOR SMALL SHOPS.

BY MESSRS. ALLEY AND MACLELLAN, LTD.

A SPECIAL type of air compressor for small shops and for mining purposes has been evolved by Messrs. Alley and Maclellan, Ltd., of Glasgow, who during the past four years have made these machines the subject of exhaustive experiment. They are single stage machines intended for use where only a small amount of compressed air is used, up to 100 lb.

As will be seen from the accompanying section, the machines are simple in action, the pistons being actuated by a belt-driven crank-shaft. The air is drawn into the cylinders on the down stroke, and compressed and expelled on the upward stroke. The crank case and cylinders with their jackets form one substantial casting, while the pistons, which are of great depth, are each fitted with three Ramsbottom rings. The loose pulley runs on a bronze bush. As there are only six enclosed bearings working in an oil bath, the machine runs for long periods without attention. The valves, we are assured, have been tested for long periods night and day in an experimental apparatus at 1,200 revolutions per minute, with entire success. The compressor, which is known as the "Sentinel Junior," is being used both belt and motor-driven for working in pits, breweries, oil works, air lift pumping, pneumatic tools, driving steam hammers, etc. Fig. 2 shows this machine adapted as a portable plant.

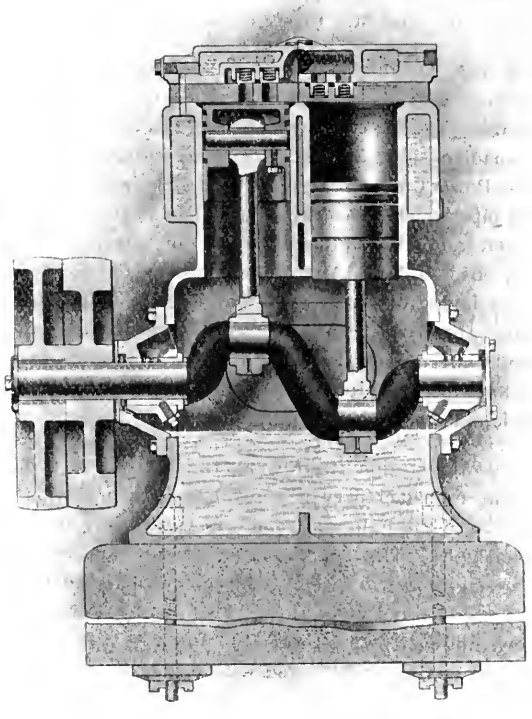


FIG. 1. SECTIONAL VIEW OF SMALL COMPRESSOR.

In fig. 3 is illustrated one of this firm's larger type of two stage vertical compressors, similar to those in use in H.M. Dockyards, the French arsenals, etc. These machines are made in sizes up to 4,100 cubic feet, and can be arranged either for belt, steam, or motor drive. The machine illustrated was direct-coupled to a 225 h.p. gas engine, and is installed in the Tyne district for a large shipbuilding firm. Messrs. Alley and Maclellan have recently erected two machines, each direct-coupled, to large gas engines, for Messrs. Beardmore and Co.'s Dalmuir Works. Each of these machines is capable of delivering 2,300 cubic feet of free air per minute. They are now engaged on two sets of machines of the vertical steam-driven open type, intended for Portsmouth Dockyard. These are each capable of delivering 2,000 cubic feet of free air per minute.

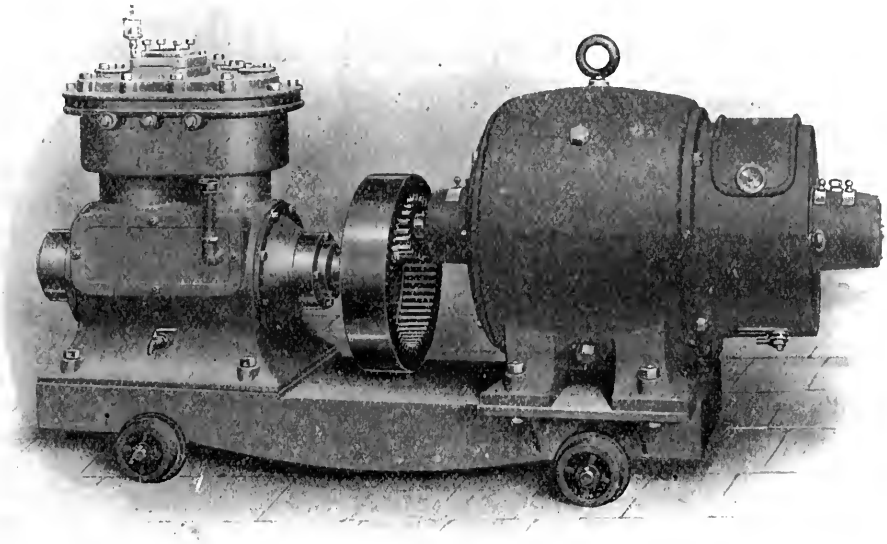


FIG. 2. "SENTINEL JUNIOR" AIR COMPRESSOR ARRANGED AS A PORTABLE MOTOR-DRIVEN PLANT.

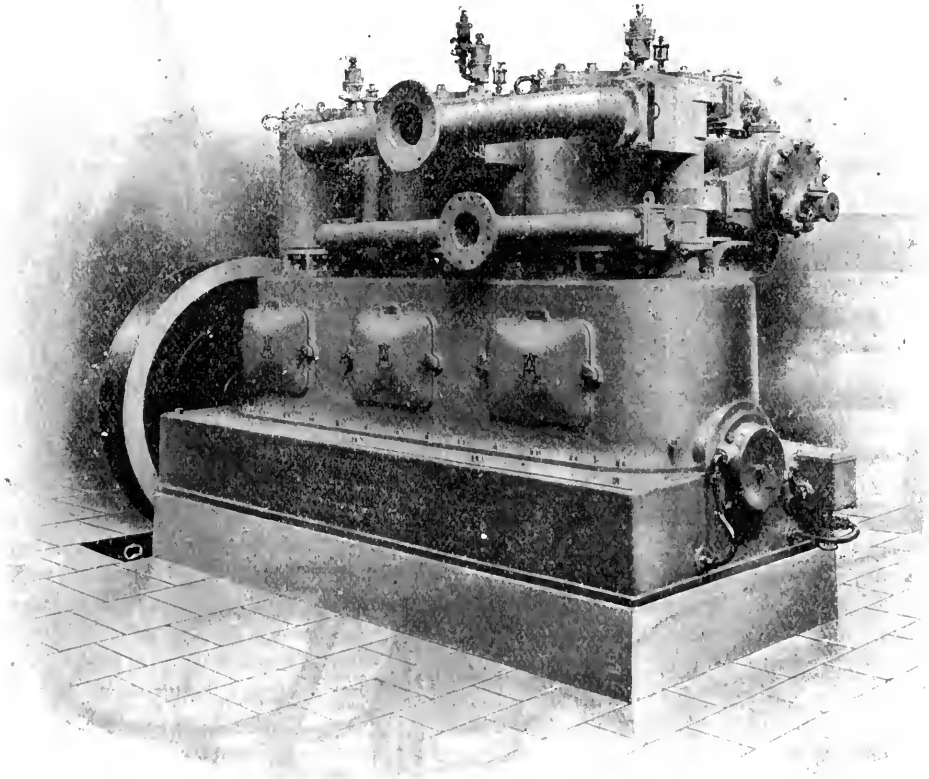


FIG. 3. TWO-STAGE AIR COMPRESSOR, VERTICAL TYPE, FITTED WITH INTERCOOLERS AND FORCED LUBRICATION.

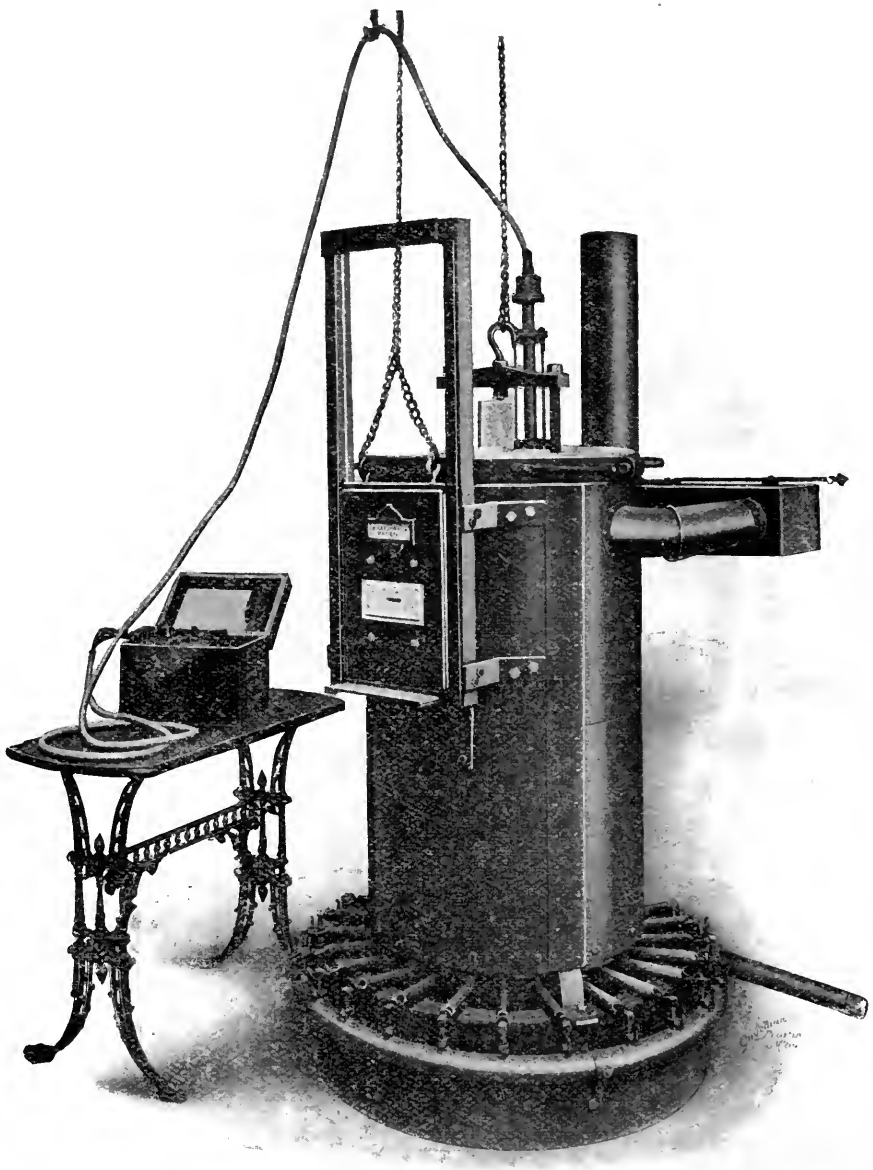


FIG. 1. THE BRAYSHAW PATENT SALT-BATH HARDENING FURNACE.

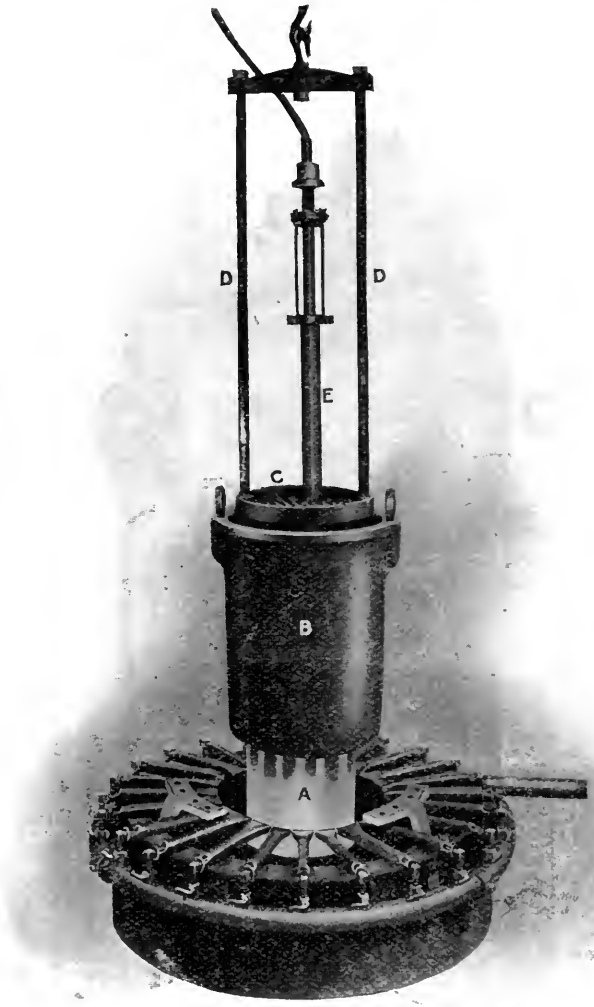


FIG. 2. THE FURNACE WITH CASING AND COVER REMOVED.

A NEW HARDENING FURNACE.

WE illustrate on the opposite page, a new form of hardening furnace invented by Mr. S. N. Brayshaw, of Manchester, in order to effect the hardening of steel articles with absolute precision. In pointing out the advantages of heating in a liquid, the inventor remarks that any article immersed for a sufficient length of time must heat uniformly to the same temperature as the liquid, and the sharpest corner cannot be overheated so long as the liquid itself is kept at the desired temperature. The advantages of heating in a liquid are so apparent that the process has been used for generations, but has made little progress, because molten lead, the medium usually employed, is, in itself, unsuitable for such a purpose, and some of the difficulties with lead are such as can never be removed.

The use of a bath of fusible salts has been known for many years, and in some few cases has been successfully applied, but the difficulties have again been sufficient to prevent any general use of the method. The obstacles in the way of using fusible salts are such as may be overcome by the discovery of a suitable salt, or mixture of salts, and by the design of the furnace. The design illustrated herewith is the outcome of many experiments, which have been undertaken by Mr. Brayshaw in order to produce a thoroughly workable furnace.

The apparatus may be heated with coal or producer-gas, and with or without blast. When fitted for blast a few Bunsen burners are also provided to keep the furnace hot at any time when the air pressure is not available. Fig. 1 shows the furnace complete, arranged with Bunsen burners, and without blast. There is an iron casing lined with firebrick, with a removable firebrick cover in halves. Fig. 2 shows the apparatus with the casing and cover removed, and the tray raised out of the pot.

A firebrick stand, A, in the centre of the furnace carries an iron or steel pot, B, containing the melt. In the centre of the furnace is also a counterbalanced tray C, which may be raised out of, or lowered into the pot at will. This tray is carried by rods D, which pass through holes in the cover. When work is to be put into or removed from the furnace the tray is raised just out of the melt to the level of the door, so that the work may be handled in the ordinary way.

It will be noticed that the tray, when out of the melt, is still inside the upper part of the furnace, which ensures it remaining at a fairly constant heat. It may therefore be raised out of the pot and lowered again repeatedly, without disturbing the temperature of the melt.

Used with the furnace is an electrical pyrometer, E, (fig. 2) passing through the cover. This pyrometer is stationary and hangs through a hole in the rising and falling tray. The lower end is continuously immersed in the melt during the working of the furnace, the upper end being connected by protected wires with the indicator, which shows the temperature within 1 deg. C.

It is claimed for this furnace that articles may be heated in it with mechanical precision. If a piece to be hardened is soaked in the melt for a suitable time, according to its size and shape, it is heated with uniformity in every part without the possibility of a hot corner, and it also acquires the same temperature as the melt, which temperature can be regulated and measured accurately. The treatment for any particular kind of steel, having once been ascertained, may be repeated with certainty. The inventor points out that the all-important part of hardening is the heating. There are two main faults in heating. They are: overheating and uneven heating, and of these the worst is uneven heating. Experiments carried out by means of the new furnace have shown the hardening point to be sharply defined, almost like the freezing point of water. Pieces heated to temperatures in the neighbourhood of the critical point, and varying from each other by only 2 deg. C., are found, after quenching, to differ considerably in their physical properties.

Contrary to the general belief, he states that it has been proved repeatedly that the manner of quenching is of very secondary importance. If the steel has been heated to the exact point required, it will harden satisfactorily in either cold or warm water or brine.

The heating process is no quicker than in an ordinary furnace, but a large number of articles may be heated simultaneously, so that a great quantity of work may be passed through the furnace in a day. The melt supplied is fluid at a temperature of 700 deg. C.

ELECTRICAL AFFAIRS.

BY E. KILBURN SCOTT, M.I.E.E., A.M.INST.C.E.

The Cutting of Insulating Materials.

With the development of electrical engineering the machinist has had to develop methods of cutting new materials, such as rubber, vulcanite, mica, etc. Rubber can be cut by a knife kept moistened with water, or by a solution of potash. For cutting mica the general method is to employ a guillotine, such as is used for trimming off the edges of paper. Where round washers or other shapes, which cannot be dealt with in the guillotine, are necessary, then the mica is punched out after first moistening it with turpentine.

Machining Large Diameter Armatures.

For machining large diameter alternator rings, it is usual to employ a horizontal face plate lathe or boring mill. Owing to the diameters of alternators having increased very rapidly of recent years, the distance between the uprights carrying the bridge has to be very considerable, and it is not every shop that can afford such large tools. The difficulty might be overcome by rotating the cutting tools, instead of the armature ring. In this way the upright coulds be done away with, there being merely a rigid central column on which the cross arm tool holder could rotate.

Construction of Shaping Machines.

In a slotting machine, the cutting stroke is in the direction of the bedplate, on to which the work is temporarily bolted, but in a shaping machine the working stroke is outward, or away from the bed frame to which the work is bolted. Now, if the tool were made to cut on the home stroke, it would probably make a cleaner cut, and the working bar being tension instead of compression, could be of steel of light construction. The work also would be under better observation. When using a keyhole saw the ordinary carpenter cuts on the pushing stroke, and naturally breaks a good many saw blades, whereas the Japanese carpenter is wiser, and cuts on the pulling stroke, which is the stroke suggested above.

The Depth of Commutator Segments.

In many specifications there is a clause to the effect that the depth of the commutator segments shall be 2 in., this being a survival from the time when a certain amount of sparking was accepted and gauze brushes were employed. There was then a good deal of wear on the commutator, but with carbon brushes the wear is almost unappreciable, and depth of segment has not, therefore, the same importance. Deep segments are not only expensive, but the commutator is not nearly so good a construction, for the segments have a tendency to lie over at an angle if they get the least bit slack. With carbon brushes the peripheral speed of the commutator must be lower than when gauze brushes are employed, about 2,500 ft. a minute being the maximum and of course with a shallow segment this can be more easily attained. At a high revolution a couple of inches on the diameter makes considerable difference.

The Unique Simplicity of Electric Furnace Working.

Some readers may remember that on the occasion of the visit to the Institution of Electrical Engineers to Rheinfelden some years ago, the Power Station was thrown open, but the aluminium, carbide, and other electro-chemical and metallurgical processes were not shown. The proprietors were, of course, quite justified in this, especially so because electro-chemical and metallurgical processes are so excessively simple that their inspection by so many foreign engineers would have probably produced a crop of rival concerns.

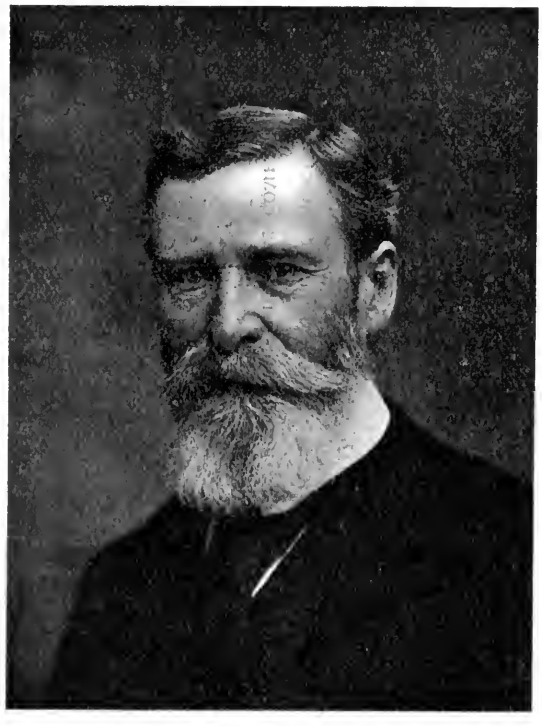
Take the manufacture of carborundum for example—Coke, glass, sand, and sawdust are mixed together and placed in furnaces 22 ft. long by 8 ft. in diameter. About two-thirds of the diameter is filled in with the mixture, and then the centre is scooped out to allow of a core of granulated coke 3 ft. diameter being placed between the electrical terminals. These consist of carbon blocks 4 in. square, and 32 in. long, packed together with flat copper strips. About ten of the strips are each attached to a separate cable. Alternating current at 150 volts is first applied, but as the furnace heats up the resistance falls, and the pressure is reduced. At the end of the run the carborundum is broken, ground and washed, and then sifted mechanically by passing it over mesh trays which are kept oscillating. The output of one of these furnaces is 2 tons in 36 hours.

OUR WEEKLY BIOGRAPHY.

MR. JOHN CLARKE HAWKSHAW, M.A., M.Inst.C.E., F.G.S.,

Member of the Council of the Institution of Civil Engineers.

MR. J. C. HAWKSHAW was born in 1841, and at the age of nine he was enrolled as a student of Westminster School. In 1860 he gained a scholarship for Trinity College, Cambridge, where four years later, he took his degree in mathematical tripos, ninth senior optime. He was president of the University Boat Club, and he rowed two years in the eight at Putney and won the Colquhon Sculls. In the general election of 1864, Mr. Hawkshaw contested the borough of Lyme Regis, losing the seat by only nine votes.



Photo, Elliott and Fry.

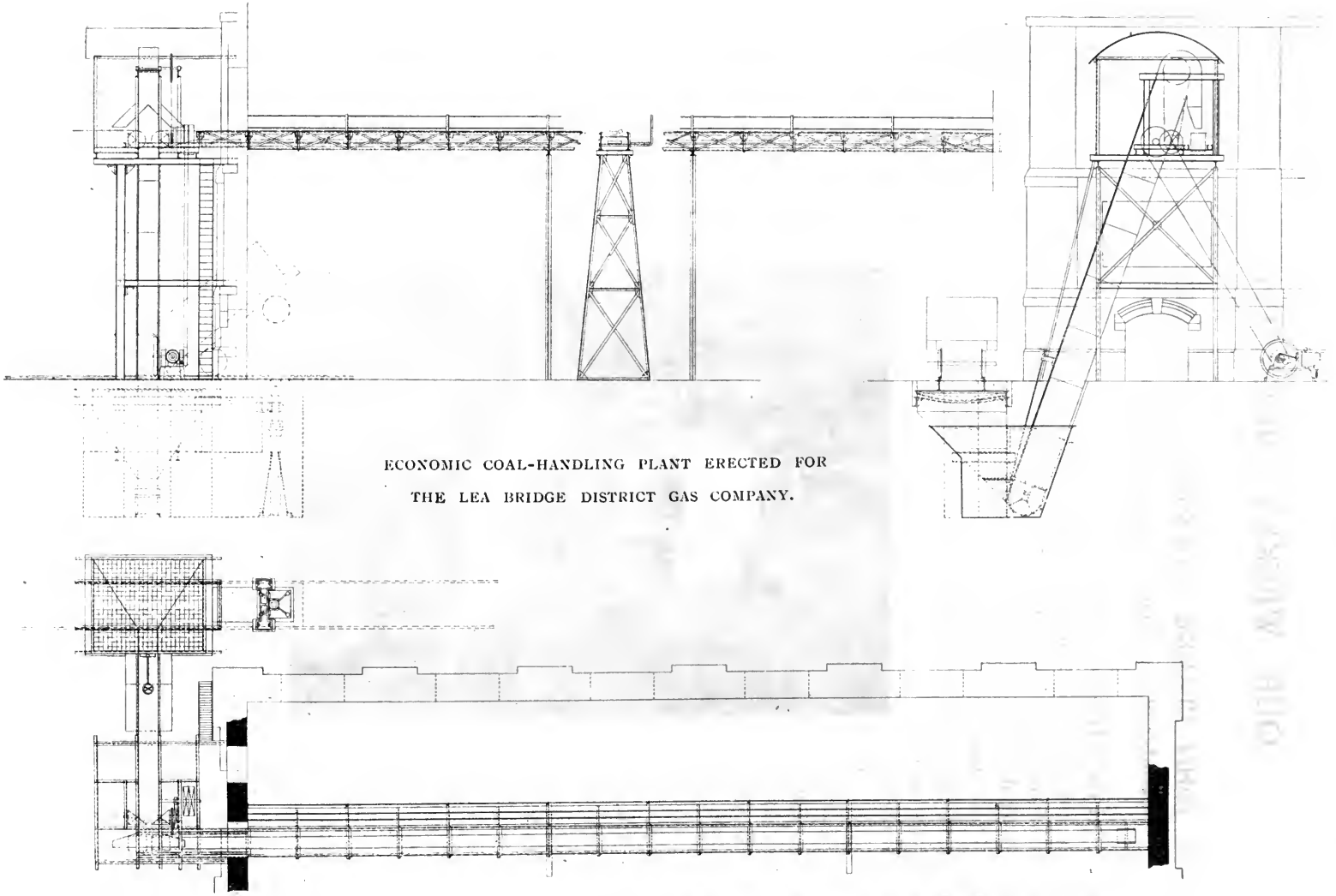
MR. J. C. HAWKSHAW, M.A., M.INST.C.E., F.G.S.

His professional career began in 1865 when he entered the office of his father, the late Sir John Hawkshaw, of Great George Street. After five years' experience he was taken into partnership, together with the late Mr. Harrison Hayter. Sir John Hawkshaw retired in 1890 and his son continued in the practice with Mr. Hayter, with whom was associated Mr. James M. Dobson, as resident partner in the Argentine Republic.

Mr. Hawkshaw was resident engineer on the Albert Docks at Hull, and he has personally superintended a number of other important engineering enterprises, including the Severn Tunnel, Middle Level Drainage, and the Dover Docks. Conjointly with his partner, he is consulting engineer to the Madras Railway Company, the Mauritius Government Railways, and the Board of Trade for Holyhead Harbour.

In the practice of his profession Mr. Hawkshaw has made many expeditions abroad; he went to Egypt in order to survey the first cataract at Assouan; he has also travelled in Russia, Holland, Belgium, and France, and he has been to South America four times—on three occasions in connection with the extensive dock works at Buenos Aires, which were carried out under the direction of his firm.

Mr. Hawkshaw was elected a member of the Institution of Civil Engineers in 1867, a member of the Council in 1889, and in 1902 he was made president. He is also a Fellow of the Geological Society, a member of the general committee of the British Association, Colonel Commandant of the Engineer and Railway Volunteer Corps, and a member of the Army Railway Council.



ECONOMIC COAL-HANDLING PLANT ERECTED FOR THE LEA BRIDGE DISTRICT GAS COMPANY.

The above plan and elevations show the latest form of coal-handling plant erected by Messrs. Graham, Morton and Co., Ltd., of Leeds. The band conveyor handles 25 tons of coal per hour at a normal speed of 200 ft. per minute.

Economic Coal-Handling Plant for the Lea Bridge District Gas Company.

The coal-handling plant, of special design, for which the Lea Bridge District Gas Company have placed the order with Messrs. Graham Morton and Co., Ltd., Leeds, is to be constructed to the plans of Mr. F. W. Cross, A.M.I.C.E. The plant is very complete; it is simple in conception and promises to be effective in operation.

From the drawing on the opposite page it will be seen that a hydraulic wagon tipper is provided, capable of raising the ordinary standard railroad wagon to an angle of 46 deg. The wagon tipper is suitable for a working pressure of about 700 lb. per square inch. This hopper is fitted with a flat-bar screen on the top, so that all the large coal can be broken before passage to the elevator. The under-side is arranged to accommodate a jigger feeder for regulating the supply of coal to the elevator. The latter is of the cased-in type, the dimensions being 18 in. and 45 ft. between centres. It is provided with a breeches shoot at the head, with flap door, and levers for operating it.

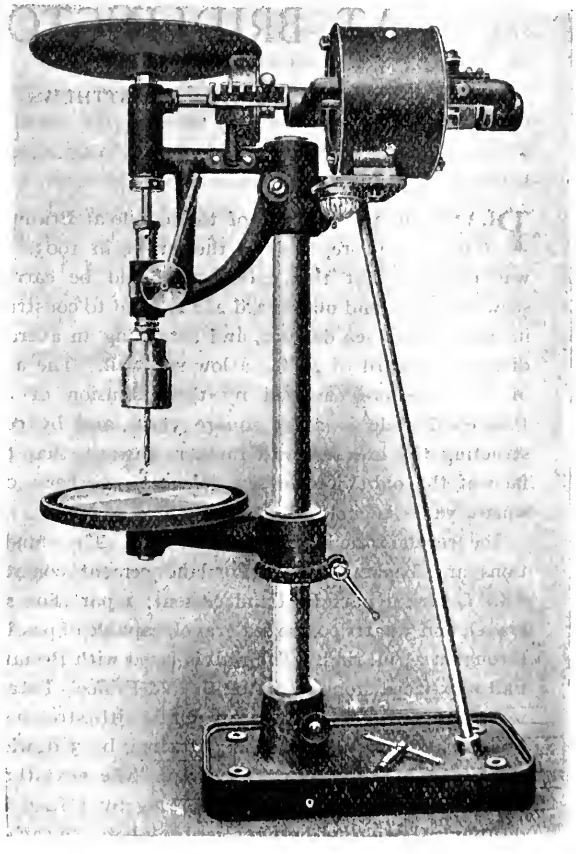
The band conveyor is of the 16-in. standard type 106 ft. between centres, and capable of conveying 25 tons of coal per hour, at a normal speed of 200 ft. per minute.

A standard travelling throw-off carriage, for delivering the coal on either side of the conveyor, is to run the entire length of the stores. The friction gear is so arranged as to admit of the carriage running in either direction, as required

The Phœnix Electrically Driven Sensitive Drill.

We illustrate on this page a very neatly-arranged sensitive drill, electrically driven, which has recently been put on the market by the Phœnix Dynamo Manufacturing Company, Ltd. A general view of the tool, arranged as a bench drilling machine, is represented herewith, but it is also made as a column tool. Its designed speed is 1,200 turns per minute. The column of the tool is of bright rolled steel, 2 in. in diameter; it is secured to the base plate by a cotter pin, and carries at its upper end the head-stock frame, on the back of which provision is made, as shown, for the attachment of the motor. A backstay, arranged as shown, stiffens the bracket against side-deflection under the thrust of drilling, enabling quick work to be effected without the risk of broken drills. The drill spindle is driven by friction gear. The drive is of the disc and roller type, and the speed can be instantly changed to suit any size of drill within the capacity of the machine, by shifting the roller along its shaft. Notches, as shown in figure, are provided for the shift-lever to rest in, each of which corresponds to the spindle speed desirable for the size of drill marked on it. The drill chucks fitted take up to ½ in. drills, and the tool is quite capable of putting these through steel boiler plates, if required, with a feed of 1½ in. to 2 in. per minute. In brass the same sized hole can be drilled with a feed of over 3 in. per minute, and ¼ in. holes with a feed of 6 in. to 7 in. per minute.

The motor takes a current of only one or two amperes at normal output, and no special starting switch is therefore required, an ordinary simple tumbler switch with "off" and "on" only doing all that is required.



PHŒNIX DRILL ARRANGED AS A BENCH DRILLING MACHINE

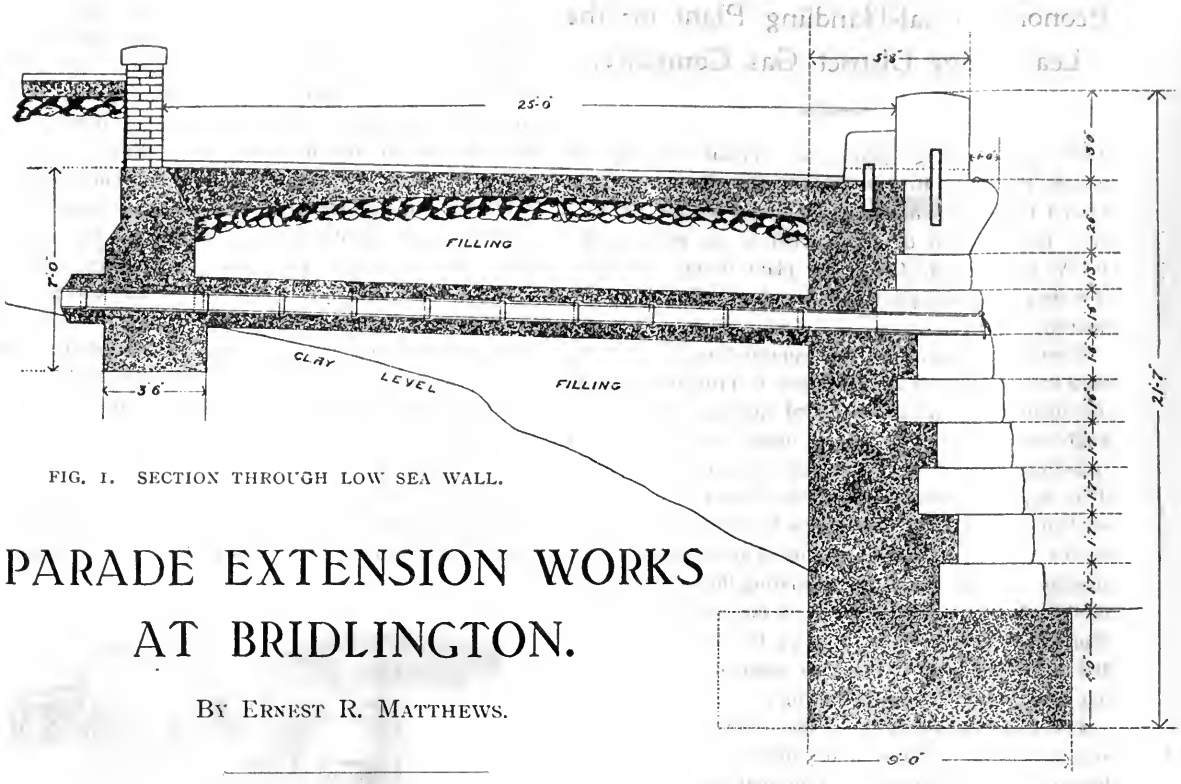


FIG. 1. SECTION THROUGH LOW SEA WALL.

PARADE EXTENSION WORKS AT BRIDLINGTON.

By Ernest R. Matthews.

PLANS for an extension of the parade at Bridlington were prepared by the writer in 1903. It was resolved that this extension should be carried seaward 40 ft., and northward 212 ft., and to construct in front of this sea defence, and extending an average distance seaward of 20 ft., a low sea wall. The area of the foreshore enclosed by the extension of the Prince's Parade is 2,015 square yards, and by constructing the low sea wall further seawards than the face of the old Victoria sea defences, another 1,000 square yards is enclosed.

The length of the big sea wall is 355 ft. The foundations and backing are of Portland cement concrete 6 to 1, viz., 1 part Portland cement, 1 part fine sea gravel, and 5 parts coarse sea gravel, capable of passing through a 2½-in. ring. The wall is faced with Bramley Fall rock-faced stone to match the old Prince's Parade wall. The first six courses are built with stretchers, each stone being not less than 5 ft. long by 3 ft. wide, by 2 ft. 1 in. to 1 ft. 10½ in. deep. The next three courses consist of stretchers 5 ft. long by 1 ft. 9 in. deep by 3 ft. wide. There is a set back between each of these courses, commencing at the bottom three courses with 12-in. set back, the next two courses with 9-in. set back, and the next four courses with 6-in. set back. The concrete foundations are carried down deep into the boulder clay; they are 4 ft. 8 in. in depth and 15 ft. 6 in. in width. All face joints in the sea walls are pointed up with Roman cement. The pointing up of the face joints of a sea wall is a very important matter, as there is a danger of air and water penetrating the joints, and by their pressure and elasticity causing stones to move after the blow of a wave. The big sea wall has no apron at its base; the reason for this is that the scour at the base of the wall is really very little, if any, owing to the wall having been designed in the stepped form. Where an apron at the foot of a wall is necessary, the writer is in favour of the stepped form of apron, which, in his opinion, is the only really effective type of apron.

CONSTRUCTION OF SEA WALLS.

The writer considers that where stone can be brought to the site at a fairly reasonable rate, that is the best form of sea wall to construct, as the first cost is the last. Experience teaches that a wall with a smooth face, especially if it be a curved face, creates a very much greater scour at the base than a wall similar to those under consideration, as the stepped face breaks the force of the wave and lessens the scour at the base of

the wall very materially. Walls built of concrete *in situ* are a constant source of expense. Concrete blocks either with or without granite spalls on the face are advocated by many engineers, and are certainly a very great improvement on the concrete *in situ*, and where stone is costly owing to excessive railway carriage they can with very great advantage be used; but the writer maintains that they are not so satisfactory as stone for the facing of a wall.

Undoubtedly the most suitable stone to face a sea wall with is granite, especially where the foreshore is chiefly shingle and H.W.O.S.T. rises several feet up the wall. In Holland and Belgium, as is well known, the sea walls are mostly built with a big slope about 1 in 2 forming a masonry embankment. The foot of the wall is protected from the scour of the waves by an apron, which is usually faced with stone pitching, generally basalt. There are only one

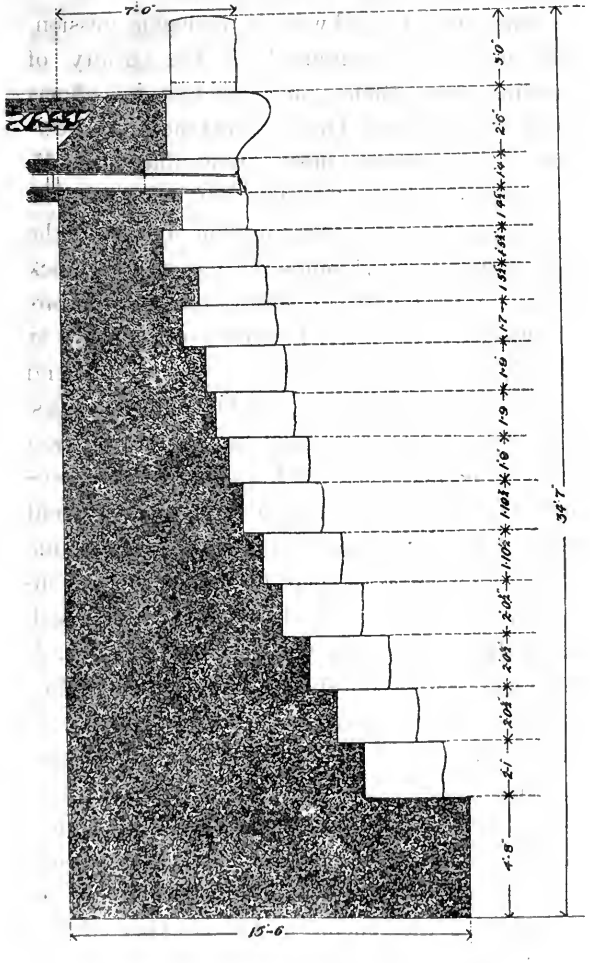


FIG. 2. SECTION THROUGH HIGH SEA WALL.

or two walls of this type in this country, one being at Blackpool. The writer considers that a wall of this description may be suitable where sand dunes have to be faced, as in Belgium and Holland; but is of opinion that this type of wall is not suitable for our coast. The stepped form of wall has been objected to on the ground that it affords a broken surface for the waves to act on, and from the stones not being placed directly over each other, the superincumbent weight which, in a vertical wall, assists in keeping the lower stones in their places, is lost in this form of wall. With regard to the first objection, one of the greatest advantages of this type of wall is, in the writer's opinion, that it has a broken surface for the waves to act on, thereby breaking up the force of the wave as it strikes the wall, and, what is even more important, reducing the scour at the base of the wall by catching the water on the steps as it falls; no other type of wall gives these advantageous results. The writer considers the second objection to be merely theoretical, as in practice no detrimental effect takes place on that account.

In the construction of the sea walls at Bridlington the beds of all stones were roughly dressed and the vertical joints were finely picked. It is considered very unwise to put in concrete blocks or stones with smooth beds and smooth vertical joints. The power of resistance is greatly reduced by so doing. Mr. Thomas Stevenson in "The Design and Construction of Harbours," says that by allowing the stones to have a smooth bed we at once reduce the power of resistance by about one-fourth. This was no doubt arrived at after careful experiment, and is a very important matter.

THE LOW SEA WALL.

The length of the low sea wall is 455 ft. It is faced with Bramley Fall rock-faced stone, with concrete foundations and backing 6 to 1 as previously described for the big sea wall. The foundations are entirely in the boulder clay; the width of the foundations is 9 ft.—except where a greater width of concrete had to be put in, and other precautions taken, necessary owing to several bad cuttings being met with—and the depth is 4 ft. The top of this wall is 13 ft. above sand level, 16 ft. above clay level, 21 ft. 7 in. above the bottom of the foundations, and 8 ft. above high water of spring tides. The writer has constructed steps projecting beyond the face of a sea wall, and those set in within the line of a sea wall, and his experience teaches him that this latter method should, wherever possible, be adopted.

At the back of the low sea wall is a concrete arch, which springs from a concrete retaining wall. This

wall varies in height, but the average height is 7 ft. The writer considers that a concrete arch should be put in at the back of a sea wall, wherever the sea is likely to frequently fall with considerable weight upon the promenade at the back of such wall.

At the back of the low sea wall there are a number of terraces, the level of the first terrace (the bottom one) above O.D. is 15 ft. The second terrace is 18·25 ft.; the third terrace is 26·25 ft. The fourth terrace varies from 39·9 ft. to 35·29 ft. Dividing these terraces are retaining walls. Flights of steps also lead from one terrace to the other. The cross gradient of the bottom terrace is 1 in 50, the second 1 in 60, the third 1 in 60, the fourth 1 in 90. The longitudinal gradient of the terraces is practically nil. The total length of the retaining walls is nearly half a mile.

Abstract of a Paper read before the Society of Engineers.

NEW RAILWAY PROJECTS.

ACCORDING to the North China Herald, the Ching-Han railway now nearing completion, will become a strong factor in the opening of the interior of China. Starting from Pekin, it is constructed right through the centre of the great plain to the city of Hankow, the great growing emporium on the Yangtze river. It passes through three provinces (Chihli, Honan, Hupeh) and the prefectural cities of Paoting and Shuntê in Chihli; Changtê and Weihui in Honan. From Pekin to the Yellow River the track is 620 kilometres long, and from the Yellow River to Hankow 515·5, or nearly 1,200 kilometres altogether. The bridge over the Yellow River is being rapidly built. There will be 102 spans, but not of equal dimensions. Already 22 are completed from the south and ten from the north side. It is expected that the work will be finished in about five months.

The Herald states further that under present conditions, the journey from Pekin to Hankow occupies five days at the least and possibly seven. In a few more months four days will suffice, and when the bridge over the Yellow River is open, the Yangtze port will be within two days' travel of the capital.

Apropos of the piercing of the Simplon, attention may be called to another engineering project of considerable importance in that part of the world. The French Ministry of Public Works has commissioned M. Jacquier to project plans for a railway between Chamonix and Aosta, involving the tunneling of Mont Blanc, and a detailed report is shortly to be laid before them. More than a quarter of a century ago, another French engineer, M. de Lepinay, was charged with an analogous mission, and was fully convinced of the utility of piercing Mont Blanc; nevertheless, his efforts came to nothing. The circumstances are however to-day much more favourable, and M. Jacquier considers the difficulty would not be so great as with the Simplon tunnel; the tunnel would be 4½ miles shorter, and the rock gives no indication of subterranean reservoirs of water. The tunnel would commence at Chamonix, 3,415 ft. above sea level, and end at Entrèves (4,550 ft.), a distance of 8½ miles. The Dora Baltea would give ample water power for the boring work, and afterwards for locomotion. It is not proposed to create *via* Mont Blanc another great international competing line. What it is wished to realise is a comparatively unassuming local line which will nevertheless be of very great service. If the engineers' favourable anticipations regarding springs and subterranean heat are realised, the tunnel will be executed at much less expense than was formerly anticipated. It is said that if a practicable and realisable project at a comparatively moderate cost is presented, the French Government will willingly lend its sanction to the scheme, and it is expected that in a few years one will be able to go from Courmayeur to Chamonix in less than half an hour.

INSTITUTION OF NAVAL ARCHITECTS.

(*Continued from page* 924.)

THE EFFECT OF MOTION AHEAD ON THE ROLLING OF SHIPS.

MR. A. W. JOHNS contributed a paper on this subject of which the following is an abstract :—

For convenience in treatment the losses of energy experienced by a rolling ship may be classified under four different headings as follows: Energy lost in overcoming frictional or skin resistance; energy lost in overcoming head resistance, that is, the steady speed resistance similar to that experienced by a thin plate moving at uniform speed through a fluid; energy lost by the imperfect restitution of energy given to the water surrounding the ship, and manifested in the creation of waves on the surface; and energy lost by the motion given to dead water at portions of the ship's immersed surface where discontinuous motion occurs. In this case the dead water and the energy given it by the ship pass away into the surrounding water, the latter being lost to the ship. This latter loss was first pointed out by Professor Bryan.

The above losses are all incurred in the surrounding water. In addition, losses must be incurred by air resistance, which, however, will be small compared with the former.

The experiments conducted by Beaufoy and Mr. Froude in water, and more recently by Dr. Zahm in air, have shown that frictional or skin resistance varies as the 1·85th power of the relative velocity of the surface and the fluid in contact. This is not greatly different to the second power of the relative velocity, and is usually taken as such.

The results of numerous experiments by various authorities, on thin plates moving at uniform speed through air and water, show that the resistance to motion varies with the square of the velocity.

The first set of experiments are those made by M. Bertin on the *Navette*. The equations of the extinction curves only are given in the paper, and these are expressed by the usual French method—viz., decrements in terms of the square of the mean angle of roll.

The second set of experiments are those made by Mr. R. E. Froude on the *Revenge*, and the results are taken from the Transactions for 1895. The extinction curves for no motion ahead, 10 knots and 12 knots, are practically straight lines. In the author's diagrams the decrements are plotted for constant angles of roll with speeds as abscissæ. The curves thus obtained are straight lines up to 4 deg. For 5 deg. there is a departure from the straight line, which is accounted for by the difficulty of taking the first angle, and that the ship has not settled down to a steady condition of rolling, the maximum angle of roll being only 6 degrees.

No periods are given in the paper for 10 knots and 12 knots speed.

The third set of results are those of experiments made by Mr. R. E. Froude on a destroyer, and are given by kind permission of Mr. P. Watts, F.R.S., etc., Director of Naval Construction. The results are very complete, and can be compared in all respects with the results of the theoretical considerations. Experiments were made at rest and ahead both with and without keels. Two experiments at least were made at each speed.

It will be seen from these figures that the decrement of roll for constant angles of roll increase uniformly with the speed. The greatest angle of roll with motion ahead being only 6 or 7 deg., the results for the higher angles are perhaps not so reliable as for the smaller angles.

It will be seen from these results that the period decreases as the speed increases. The metacentric height with keels was about 4 per cent. greater than without when at rest, but when in motion the metacentric heights were not measured. This omission is to be regretted, as no experimental information on this important point is at present available.

In the case of the *Daring*, Messrs. Thornycroft and Barnaby stated that the vessel became more tender as the speed increased, and calculations made by them showed the metacentric height at high speeds was about 2 in. less than when at rest. There is no reason to suppose any different alteration in the stability of the destroyer, whose rolling experiments are given above. The effect of the alteration is to increase the period with the speed. In addition, the result of increased resistance to rolling as the speed increases is to increase the latter. The effect of the formation of dead water, therefore, is probably greater than that indicated by the differences in the periods.

On the whole the experiments confirm the theoretical results.

HOLLOW *versus* STRAIGHT LINES.

Mr. R. E. Froude read a paper on "Model Experiments on Hollow *versus* Straight Lines," of which the following is an abstract :—

The experiments which have been made at Haslar on this subject divide themselves naturally into two

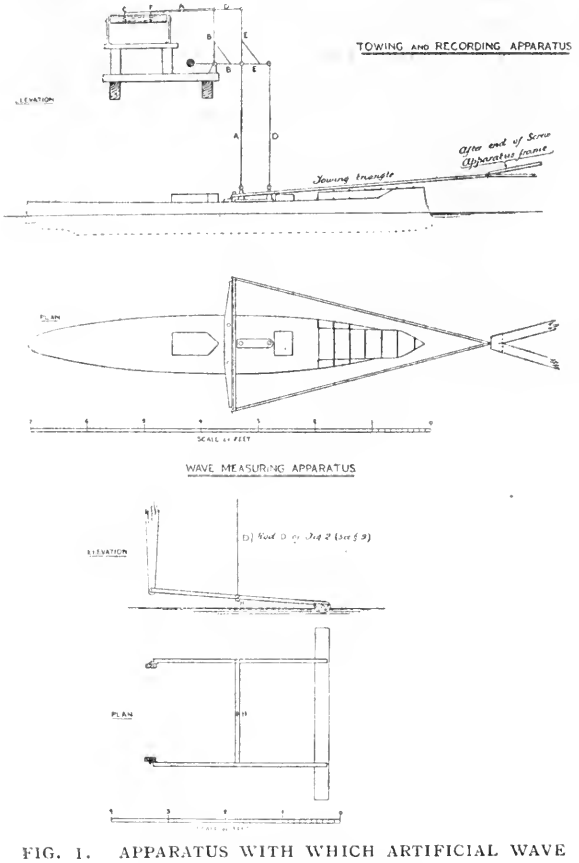


FIG. 1. APPARATUS WITH WHICH ARTIFICIAL WAVE EXPERIMENTS WERE MADE.

classes, viz. : (1) Experiments in smooth water with models of the usual size and with the usual apparatus ; (2) Experiments in artificial waves, with smaller models and with special apparatus. The special apparatus and mode of experiment employed in the latter class is illustrated in fig. 1. The "wave maker," or instrument by which the artificial waves are made is mounted at what may be called the "stopping" end of the waterway, namely, the end towards which the model runs in the experiment. It consists essentially of a vertical rocking diaphragm, hinged at its lower edge—2 ft. 4 in. below the water surface level—transversely to the line of the waterway, which is controlled to a uniform stroke and uniform period, by the crank motion shown in the figure, and by the engine of the workshop shafting from which the motion of the crank axle is taken by means of a high-speed cord belt. This rocking diaphragm, having water on both sides of it, of course propagates waves from it in both directions, *i.e.*, from its rear as well as from its face, but the rearward waves are immediately broken on the sloping "beach" behind it. The forward waves run the whole length of the waterway, with crest lines square to it, and, in virtue of the uniformity of the stroke and period of the diaphragm, form a wave system, or swell, very regular in character, through which, in the opposite direction, the model is towed in each experiment. The sea condition of ship which is represented by the model experiments in artificial waves is therefore that of steaming against a very regular head sea, like a big ground swell.

The wave height is regulated by adjusting the crank radius, and the wave heights realised—for the several crank radii and the varying periods used in the experiments—were ascertained in a special series of test experiments with the wave maker, with no model running, by means of wave-measuring apparatus described by the author.

RESULT OF EXPERIMENTS IN SMOOTH WATER AND WAVES.

The result of smooth water experiments was to show a neutral result as between hollow and straight lines for after body, the balance of efficiency advantage which the screw experiments attributed to the hollow line being cancelled by the shaft tube and web advantage of the straight line one. Experiments with artificial waves did not show any conspicuous difference in the effect of waves upon straight and hollow lines respectively such as could outweigh the serious disadvantage of the former for smooth water steaming. In the angle of pitching no difference at all could be detected (see fig. 2). The general conclusion to which the results

point is that the question of performance in steaming against a head sea is less one of particular underwater shape than one of longitudinal stability *versus* longitudinal inertia. If the shape is influential it is mainly by indirect effect upon these conditions. As to the relevance of the results to the problem of speed-keeping power of ships in actual sea, there are no grounds for thinking that a sea-way advantage of straight lines has been underrated by these experiments.

MARGINS AND FACTORS OF SAFETY.

Mr. A. E. Seaton contributed a paper on this subject. He said that every structure and machine must be so designed that when properly constructed it was capable of safely carrying the load or developing the power for which it was intended for a considerable period. With regard to boilers so long as the test was double that of the working pressure, a factor of safety of 4 was scarcely advisable. Boiler makers had to make boilers in plates 1¾in. thick when 1½in. would do perfectly well as the factor of safety would still be 3·86. A test of 40 per cent. above working pressure should be quite sufficient margin. The case of a screw shaft was an example of the other extreme. That had to withstand stresses which could not be calculated with any degree of certainty, and yet no one asked to have screw shafts tested even to the working stress.

In order that a steamship might have a margin of safety to ensure her doing the intended voyage at the scheduled speed, most shipowners insisted on having the trial trip speed considerably in excess of it; the builders accepted these conditions, and knowing they were legally liable for heavy penalties for non-performance of the speed, even when no penalty was named, usually designed the ship and provided engines and boilers for a still higher speed, so that they might have in their turn a margin of safety. Hence it came to pass that a ship whose service speed was to be 17½, not uncommonly did 19½ knots on trial under service conditions, and that, not on a series of runs on the measured mile, but on a long course often of 100 miles. The effect of this kind of margin was most serious, both on the design of the machinery and the ship. The latter must be formed with finer lines than there was really occasion for, with a corresponding loss of displacement; the machinery was much heavier and bulkier than necessary, thereby taking away from the carrying capacity and often also from passenger space as well. The engine cylinders had such clearances as to reduce the steam efficiency at the service speeds; and the screws necessary for the high trial speed were not of the best proportions for the service speeds. He thought that neither shipowners nor builders always fully realised the evils and cost of this pernicious way of ensuring satisfactory performance, some effects of which are set out in the table on page 974, where the cost of this unnecessary margin is strongly brought out. His object was not so much to advocate a factor of safety of four for boilers and a power margin for ships, as to draw the attention of shipowners as well as shipbuilders and engineers to these matters, that they might see what was really involved in getting the so-called margins of safety they so frequently demanded, and so be better able to decide whether the gain thereby obtained was commensurate with the extra cost. The boiler question was, of course, the most serious, as there seemed absolutely nothing to justify such an extravagant margin as was now imposed on shipowners to their loss and detriment.

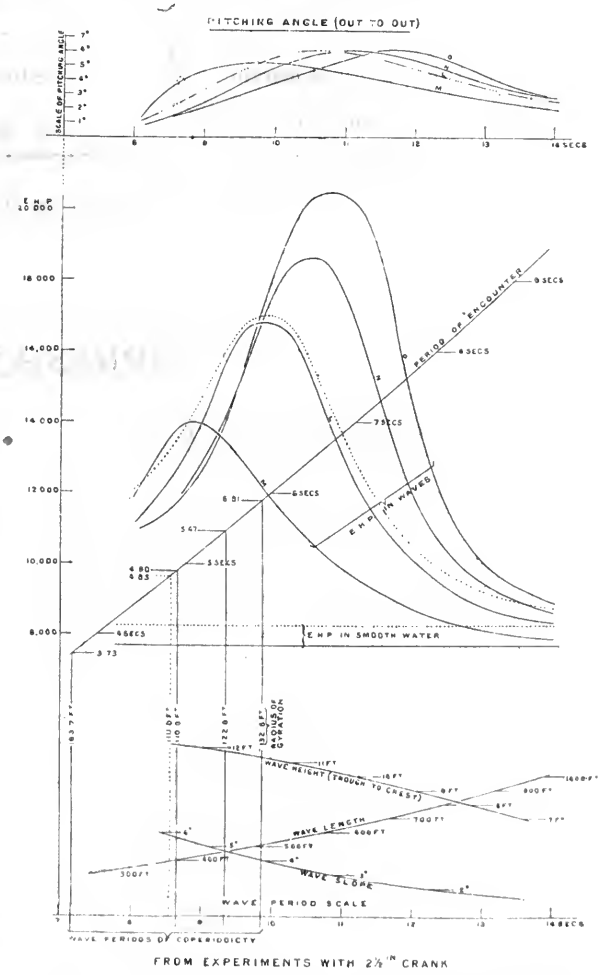


FIG 2.—SHOWING RESULTS OF WAVE EXPERIMENTS.

EXAMPLE III.—INTERMEDIATE CARGO AND PASSENGER TWIN-SCREW STEAMER.
600 Ft. × 65 Ft. × 28 Ft. Draught; Voyage Speed, 14 Knots; Cost of "A," £225,000.

	A	B	C	D	E	F
Speed on trial of 100 knots ...	14·0	14·5	15·0	15·5	14·38	1·470
Prismatic co-efficient	0·801	0·791	0·782	0·774	0·801	0·801
Displacement ... ... tons	25,000	24,680	24,400	24,150	25,000	25,000
Indicated horse-power ...	7,360	8,180	9,040	9,904	8,180	8,840
Weight of machinery ... tons	1,636	1,818	2,009	2,209	1,818	1,962
Loss of cargo capacity... tons	—	402	973	1,388	182	326
Extra cost of machinery ...	—	£6,370	£13,050	£20,055	£6,370	£11,410
Extra for interest, depreciation, and insurance	—	£796	£1,631	£2,507	£796	£1,426
Loss of earning power per ann.	—	£10,050	£24,320	£34,700	£4,550	£8,150
Freight	—	—	—	—	—	—
Total annual cost of margin ...	—	£10,847	£25,951	£37,207	£5,346	£9,576
Total cost of margin % of cost of ship	—	4.82	11.5	16.53	2.38	4.25

TABLE ILLUSTRATING COST OF MARGINS AND FACTORS OF SAFETY.

CORRESPONDENCE.

DUST IN BLAST FURNACE GAS.

To the Editor of Page's Weekly.

Sir,—Your correspondent must surely be joking when he suggests a method of removing dust from furnace gases. The comprehensive and pioneer patents of our Consulting Engineer, Mr. B. H. Thwaite, have been in service for years, and are capable of removing every particle of dust from furnace or any other kind of gases.

One element of the system is the employment of centrifugal effect due to the rotary movement at speeds of 5,000 to 10,000 ft. per minute; but centrifugal influence alone is not sufficient to prepare the gas for motor power applications, and unscrupulous persons in trying to evade the Thwaite patents have discovered this to their loss and the general detriment of the system.

We will guarantee to purify every kind of furnace-gas to the degree required for motive power purposes, and without involving any other element than is covered in our patents of 1894 and 1896.

Yours faithfully,

The Blast Furnace Power Syndicate, Ltd.,
F. F. Fuller,
Secretary.

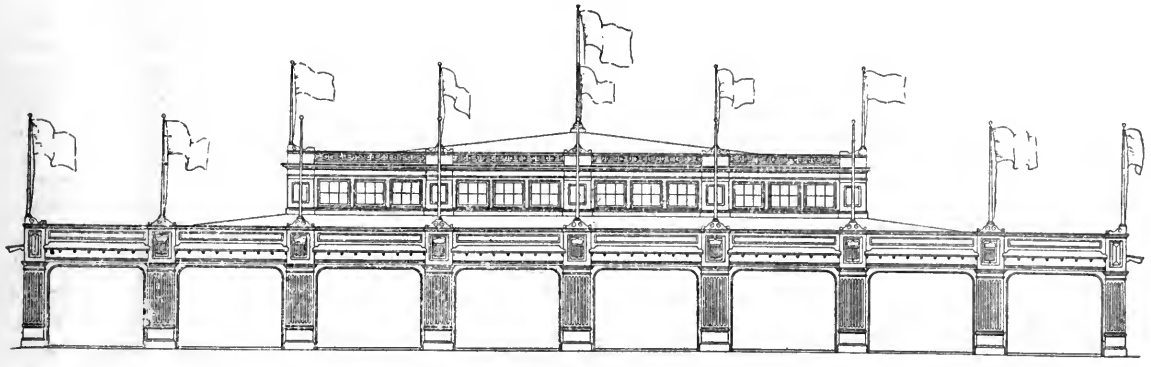
To the Editor of Page's Weekly.

Sir,—Apparently your correspondent is not cognisant of the fact that dust catchers already exist in nearly all ironworks and are far more effective than any mere twist or curl in a flue would be. The difficulty of removing dust has been solved now for some years, as he can easily satisfy himself by visiting this district.

Yours faithfully,

Locomotive.

Chesterfield, April 22nd, 1905.



AMERICAN NOTES.

Railway Exhibition.

The above illustration shows the elevation of the main exhibit building of the railway appliance exhibition which has just been opened at Washington in connection with the International Railway Congress. The Congress of the United States, with the approval of the President, has signally honoured the American manufacturers of railway appliances by the passage of an act permitting an exhibition of the products of their factories to be made on a part of the Monument Grounds in Washington. The main exhibit building is practically an open space covered by a roof, as the usual climate conditions at this period of the year do not require complete enclosure. The site of the exhibition is on the Washington monument grounds, in accordance with the special act of Congress. The main entrance to the grounds is at Fiteenth-street, where an imposing gateway has been erected. The main exhibit building is 160 by 200 ft., while the space taken up by the entire exhibit grounds measures over 200,000 square feet. In all 35 Governments and 307 railways are represented. The exhibition will continue from May 3rd to the 14th inclusive.

The Panama Commission.

The reorganisation of the Panama Canal Commission has naturally not been carried out without considerable heart burning. It is being asked in some quarters who will warrant the selection of new men in the commission of engineering and management to be superior to the one just dismissed? If selection was made a year ago of the best material the country possessed, as everyone believed, why should our opinion of those men be changed to-day? The new commission consists of seven members, as follows: Theodore P. Shonts, president of the Toledo, St. Louis and Western Railway, chairman, at a salary of $30,000 per year; John F. Wallace, chief engineer, at a salary of $25,000 per year; Charles E. Magoon, governor of the canal zone, at a salary of $17,500 per year, and the following at a salary of $7,500 per year each: Rear Admiral M. T. Endicott, U.S.N.; Brigadier-General Peter C. Hains, U.S.A., retired; Colonial O. M. Ernst, Engineer Corps, U.S.A.; Benjamin M. Harrod. Mr. Harrod is the only member of the old commission who was reappointed. It is understood, however, that a board of consulting engineers is to be appointed later, and it is expected that William Barclay Parsons and William H. Burr, members of the old commission, will be appointed on this.

A Double-Deck Subway System.

The illustration on page 977, for which we are indebted to the Scientific American, shows the double-deck subway system designed by Mr. J. W. Reno for railway transit beneath Broadway, New York. It is claimed that this double-deck tunnel will have all the advantages in convenience and economy of operation possessed by the four-track level tunnel, while at the same time it will be free from the disadvantages of encroachment upon private property, interference with building foundations, and interruption of street traffic. It is also recommended on the ground of economy. The method of construction proposed is as follows: A narrow trench would be constructed on one side of the street at a time, by driving down a special form of steel sheet piling, and excavating the ground between the sheeting. This trench would then be filled in with concrete, to form the side wall of the tunnel. The other wall of the tunnel would be constructed in a similar manner on the opposite side of

the street, after which the steel beams, which form the roof of the tunnel, would be placed in a position under the cable road structure, the tunnel roof completed, and the street surface restored. Simultaneous with the construction of the tunnel wall, the pipes, sewers, and electric wire ducts would be surrounded by a permanent pipe gallery, so that there would never by any necessity in the future for tearing up the street surface in order to make alterations and repairs. It is well known that those doing business on Broadway are put to great loss, amounting to millions of dollars in the aggregate, on account of the almost endless disturbance of the street pavement necessitated by the present imperfect arrangement of the pipe and wire systems. In the plan illustrated, there would be ample space for commodious pipe galleries on either side of the tunnel.

Important Educational Alliance.

For some time past Massachusetts Institute of Technology and Harvard University have been seriously considering the advisability of joining forces. On March 14th, the executive committee of the governing board of the Institute of Technology submitted a proposed agreement to its corporation, and the same agreement will be submitted to the Harvard governing board for action, provided the Boston institution subscribes to it. The agreement, according to the Engineering News, provides for an educational alliance between equals, there being no suggestion of an absorption of the Institute of Technology by Harvard University. Each institution is to retain it present organisation and integrity, but there will be no longer any competition in the teaching of engineering and applied sciences.

North and East River Tunnels.

Work is well under way on the tunnels under North and East rivers, by which the Pennsylvania Railroad will enter New York City. Compressed air is to be used very extensively in the pushing of the immense tubes under the rivers and according to Machinery, the compressor plants will represent the latest developments of pneumatic practice. The contracts for the air-power equipments were awarded to the Ingersoll-Sergeant Drill Company, New York, who are now installing the machinery. The work is to be carried on in two distinct sections and under separate contracts. The larger of these, for tunnelling under the East River—secured by S. Pearson and Son, Inc.—provides for building four parallel tubes between Long Island and Manhattan, each to be 33 ft. in diameter. The work is to be pushed from both ends at the same time. Machinery states that the four power plants being installed for the work represent in the aggregate the largest installation of air-compressing machinery ever made for general power purposes, and every refinement has been applied which could contribute to economy and reliability, for when the work is once under way no interruptions can be permitted

The main air-compressing plants on the East River tunnel will include twelve Ingersoll-Sergeant cross-compound Corliss steam-driven compressors, with duplex air ends of the latest type. Eight of these are low-pressure units, each with a capacity of 5,000 cubic feet of free air per minute, compressed to 50 lb. from atmospheric intake. This air is to be used for keeping out the water and mud when the shields are driven forward. There will be two high-pressure compressors designed to draw their intake either from atmospheric or from the discharge of the low-pressure machines. In the former case the capacity is 1,500 cubic feet of free air compressed to 100 lb.; in the second case it is from 2,000 to 6,600 cubic feet delivered at pressures up to 150 lb. This high-pressure air is to be used for running rock drills, driving concrete mixing machines, and possibly for pneumatic haulage. The remaining two units are combination compressors having steam cylinders coupled in tandem to two pairs of duplex high and low-pressure air cylinders. Either set of compressing cylinders may be thrown into operation, the machines thus serving as reserve units for either the high or low-pressure compressors. The contract for the North River tunnel is not so extensive.

Carnegie Institute Extension.

The magnificent extensions to the Carnegie Institute at Pittsburg are rapidly nearing completion. They represent an expenditure of $5,000,000, the munificent gift of Mr. Andrew Carnegie. The new building almost obscures the original structure, which itself, a previous gift of Mr. Carnegie, cost $3,000,000. It occupies a width of 400 feet in Forbes Street and a depth of 600 feet. In addition to the portion devoted to the library, comprised within its walls are to be found art galleries, a museum, a music hall, a lecture hall, a restaurant and the general offices required for the supervision and operation of these many divisions. The contract for the electric generators has been let to the National Electric Company, Milwaukee. It consists of five 300-kilowatt, 120-revolutions per minute, twelve-pole, 120-volt, direct current, engine type generators. The total net weight of each generator will be about 55,000 lb., the armature and commutator accounting for 18,000 lb. On the final test the generators will be expected to withstand a momentary overload of 75 per cent. without flashing,

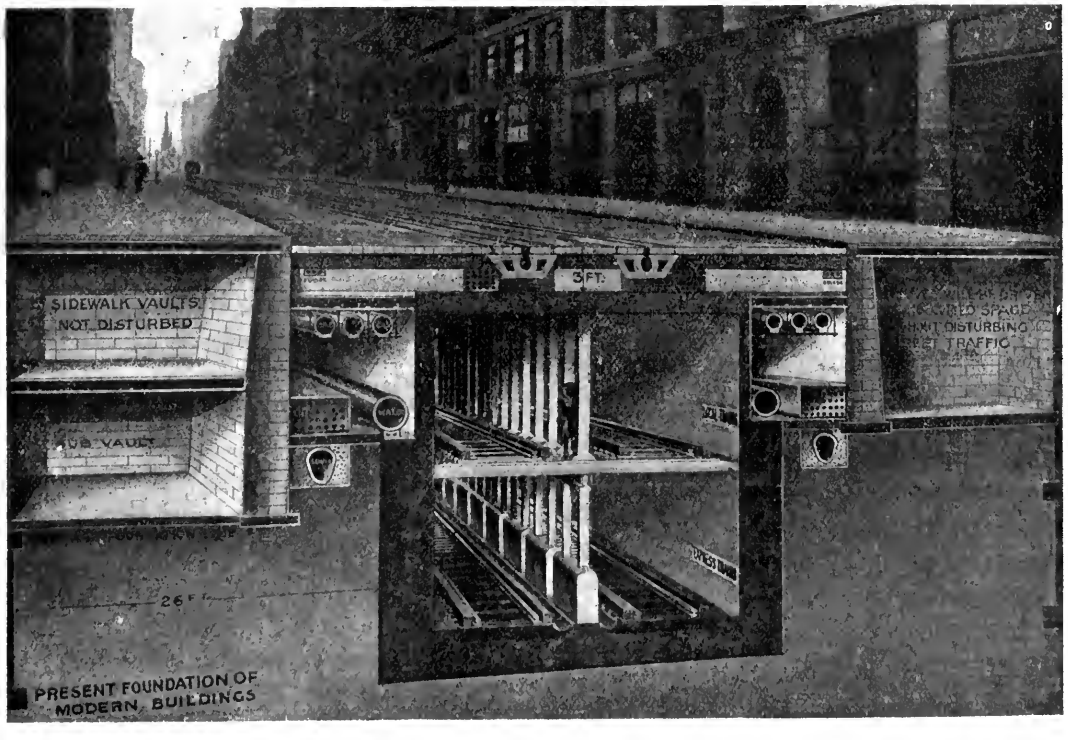
and to operate from no-load to 25 per cent. overload without shifting the brushes.

Mr. Carnegie and Annuities for College Professors.

It is announced from New York that Mr. Carnegie has made a gift of $10,000,000 (£2,000,000), to provide annuities for college professors unable to continue active work. Professors in the United States, Canada, and Newfoundland will be qualified to share in the income from this munificent gift. The trustees of the fund are chiefly presidents of important universities and colleges. Mr. Carnegie, in a letter announcing the gift, says that he regards teachers in higher educational institutions as the least rewarded of all professional men. "Few colleges," he continues, "are able to provide retiring pensions, and the consequences are grievous—able men hesitate to adopt the teaching career, and the old professors cannot be retired." The fund applies to universities, colleges, and technical schools, without regard to race, creed, or colour, but institutions imposing a theological test are excluded.

Prairie Type Locos.

Owing to the ever-increasing weight and speed requirements of their more important express traffic—included amongst which are the celebrated "Twentieth Century, Ltd.," and the "Lake Shore, Ltd.," which cover the distance of 980 miles between New York and Chicago in exactly 20 hours, including time spent at intermediate stopping-places—the Lake Shore and Michigan Southern Railway Company has quite recently introduced into service 10 powerful express locomotives of the "Prairie" type, which have been built at the Brooks works of the American Locomotive Company. These engines, which are by far the heaviest express engines in use on any railway system in the world, have six wheels coupled, with a leading "pony" truck and a pair of trailing wheels under the fire-box. The cylinders are 21½ in. in diameter with a stroke of 28 in., and the leading, coupled, and trailing wheels have a diameter of 3 ft. 6½ in., 6 ft. 7 in., and 4 ft. respectively. The total wheel-base of engine and tender is 62 ft. 4½ in. The boiler is of large dimensions, having a working pressure of 200 lb. per square inch. The fire-box is spread out over the trailing wheels, and provides 55 square feet of grate area. The heating surface amounts to 3,905 square feet. The tender is carried on two bogie trucks, and has a capacity for 7,800 gallons of water and space for 15 tons of bituminous coal. In working order these engines have the extraordinary weight of 173½ tons.



PROPOSED DOUBLE-DECK RAILWAY UNDER BROADWAY.

A PETROL FIRE EXTINGUISHER.

AUTOMOBILISTS will welcome the news that an invention has been perfected which will put out petrol flames as easily as water will extinguish an ordinary conflagration.

THE "NEW ERA" EXTINGUISHER.

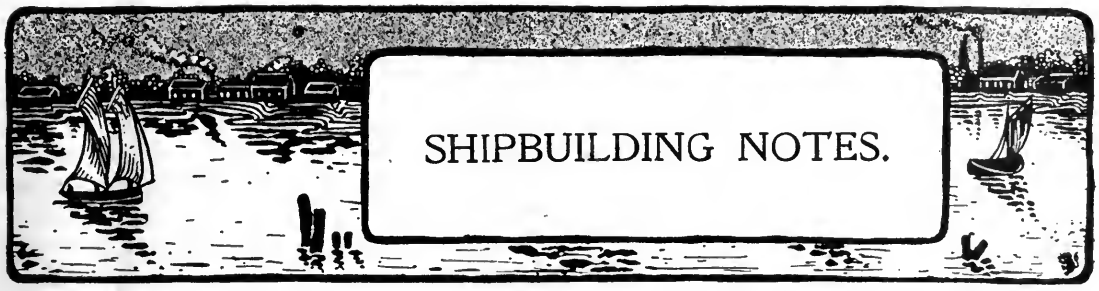
The apparatus referred to, which is known as the "New Era" Petrol Fire Extinguisher, has been designed to meet the demand for an effective and inexpensive fire appliance which can be easily carried on car or boat, and fitted in motor houses.

The general arrangement will be understood from the accompanying illustrations. The extinguisher is constructed of copper, tested and guaranteed to stand pressure of 350 lb. to the square inch. The hose is capable of throwing a solid stream of the extinguishing liquid for a distance of 60 ft., this effect being brought about simply by turning the apparatus bottom end up and bumping the plunger on the ground. The plunger perforates a mica disc of a bottle containing acid, and alkali water coming into contact with the acid, forms the fire extinguishing chemical which at once escapes through the hose. The charge is guaranteed to be entirely harmless to machinery, and a point worth noting is that the extinguisher can be recharged, as necessary, at a nominal cost.

Among a number of remarkable tests which have have been carried out to prove the efficiency of this apparatus, was a trial carried out on Teddington Reach by the Marine Motor Association, in the presence of the Thames Conservancy officials, and reported in the Motor Boat. For the experiments an old boat was fitted up with a rough imitation of a motor which was made out of an old paint drum partly filled with paint, to represent the engine and oil, etc. The Motor Boat states that for the test two gallons of petrol were poured into and all over the boat, making a terrific blaze when ignited. The fire was completely extinguished, and on examining the boat, to everyone's surprise it was found that she was not damaged in the least, only the paint being charred and blistered, whilst the wood itself was untouched. Altogether it was a most successful demonstration of the powers of the extinguisher under the worst conditions the inventors have ever experienced, and it proved that a petrol fire is not inextingushable.

SMALL EXTINGUISHER FOR MOTOR-CAR USE.

The apparatus is made by the Valor Company, Ltd., of Birmingham and London. The smaller illustration shows the motor-car size of extinguisher, which can be enclosed in a neat basket case and attached to the car ready for use.



SHIPBUILDING NOTES.

On the 22nd ult., Messrs. R. Craggs and Sons. Ltd,, launched from their Tees Dockyard, Middlesbrough, a steel cargo steamer 341 ft. long by 47 ft. beam, by 24 ft. 7 in. depth moulded. This vessel has been built under special survey to take the highest class under British Corporation three deck rule, with one deck laid, having poop, bridge, and forecastle. The machinery will be fitted by the Rotterdamsche Droogdok Maatschappij of Rotterdam, and will have cylinders 22½ in., 37½ in., 62 in. by 42 in. stroke, steam being supplied by two large single-ended boilers working at a pressure of 180 lb. to the square inch. The vessel has been specially built for the heavy timber trade. She has only two holds, one forward and one abaft the machinery space, and is so constructed with girder frames and girder beams that there is not a single pillar or beam within the holds, the whole length and breadth being available for handling long pieces of timber. As the vessel left the ways she was christened *Sliedrecht* by Miss May Craggs.

On Thursday, the 20th ult., Messrs. Ramage and Ferguson, Ltd., launched from their yard at Leith, a twin-screw steam yacht of over 1,000 tons Thames measurement, which they have built on account of the Baron de Forest. On leaving the ways the yacht was named *Honor* by the Countess of Mar and Kellie. The vessel is constructed on the double-deck principle. She has five watertight bulkheads and will be classed 100A1 at Lloyd's. The dimensions are, 260 ft. over all, 213 ft. on the water line, 31 ft. beam, by over 16 ft. deep. The yacht is not intended to be a speedy craft, but will cruise at a mean of about 13 knots. She will be propelled by twin screws driven by two sets of triple expansion engines, capable of indicating 1,400 h.p. There is one large single-ended main boiler having a working pressure of 180 lb. and a Blake donkey boiler for work in port. She will have a coal storing capacity of about 230 tons, which should enable her to cross the Atlantic without re-coaling. This was the last vessel to be designed by the late Mr. G. L. Watson.

On the 18th ult., Messrs. William Doxford and Sons, Ltd., launched a turret deck steamer built on the single-deck principle to the order of The British India Steam Navigation Company, Ltd., London. The s.s. *Queda* is a vessel of 480 ft. by 58 ft. by 33 ft., and has a total deadweight capacity of not less than 12,000 tons. Her gross register will be about 7,700 tons, and her net register about 4,900 tons. She has a cargo space of no less than 690,000 cubic feet, and will carry about 4,000 tons of water ballast. She is fitted with tri-compound engines by Messrs. Doxfords, 27½ in., 45½ in., 75 in., by 54 in., and three boilers with Howden's system of forced draught of 180 lb. pressure.

At Alloa on the 21st ult. there was launched from the new yard of Messrs. Mackay Bros., a steel screw steamer 135 ft. b.p. by 23 ft. 6 in. by 12 ft. 6 in moulded, built to the order of The Anglo-Belge Company, Messrs. J. and R. Grant, London, managers. The vessel has been built to Lloyd's highest class under special survey, and is intended for a new fast direct weekly service between the cities of London and Brussels, being specially designed for the navigation of the Brussels Canal. The vessel is of the raised quarter-deck type, with bridge, forecastle and poop. Triple expansion engines placed amidships are being supplied by Messrs. MacColl and Pollock, Ltd., Sunderland, the cylinders being 13 in., 22 in., and 36 in. by 24 in. stroke: boiler, 12 ft. 6 in. diameter by 10 ft. long, working at a pressure of 160 lb. The vessel was named *Prince Leopold* by Mrs. Mackay. The builders have on hand for the same owners a duplicate steamer to be launched in a fortnight for the same route.

The new steamer *City of Karachi*, built by Messrs. Workman, Clark and Co., Ltd., Belfast, for the City Line branch of the Ellerman Lines, Ltd., recently went through a very satisfactory trial cruise in the Belfast Lough. The vessel has been built for the City Line Service between Glasgow, Liverpool, London and Calcutta, and has a gross tonnage of

over 5,500. Special attention has been given to the accommodation provided for passengers. The machinery, consisting of a set of modern quadruple expansion engines, supplied with steam by three steel multitubular boilers working under Howden's system of forced draught, has been constructed at the builders' engine and boiler works.

On the 20th April, Messrs. Harland and Wolff, Belfast, launched the large steel twin-screw passenger steamer *Amerika* for the Hamburg-American Line. The new steamer has a gross tonnage of about 22,800 and when completed will be the largest vessel afloat outside the British Mercantile marine. She will be fully fitted up for a very large number of first, second, intermediate and third-class passengers, the accommodation for the higher class passengers being most elaborate and luxurious, and that for the other classes also exceptionally good. As usual in the large vessels built by this firm, the machinery is of their quadruple expansion balanced type, reducing vibration to a minimum.

The launch of the *Amerika* was made unusually interesting by the presence of three members of the Government: The Lord President of the Council (Lord Londonderry), The Chief Secretary for Ireland (The Right Hon. W. H. Long, M.P.), and the Solicitor-General for England (The Right Hon. Sir Edward H. Carson, M.P.). The owners were represented by Captain Sauermann, Mr. C. Van der Smissen and Mr. J. Edelmann.

On the 19th ult. there was launched from the Wallsend Shipbuilding Yard of Swan, Hunter and Wigham Richardson, Ltd., a steel screw steamer, which has been built for the Hall Line service of the Ellerman Lines, Ltd. The dimensions of the vessel are: Length, over all 387 ft.; beam extreme, 47 ft. 5 in., and depth moulded 30 ft. 9 in. The vessel has been designed to carry a deadweight cargo of about 7,000 tons on a moderate draught of water. The machinery has been constructed by the Wallsend Slipway and Engineering Company, Ltd., and consists of a set of triple expansion engines, having cylinders 23½ in., 40 in., 69 in., with 48 in. stroke, steam being supplied by two single-ended boilers fitted with Howden's forced draught, and working at a pressure of 212 lb. per square inch. The vessel is being built to the rules of the British Corporation for the Survey and Registry of Shipping and will take their highest class.

The s.s. *Archbank*, built to the order of Messrs. The Peareth Steamship Company, Ltd., was launched from the yard of Messrs. Furness, Withy and Co., Ltd., Hartlepool, on April 19th. The vessel is over 350 ft. in length and has a cubic capacity of about 339,936. She is built on the web frame principle of the spar deck type, with poop, bridge and forecastle and takes Lloyd's highest class. Triple expansion engines will be supplied by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, having cylinders 24 in., 39 in., 66 in., by 45 in. stroke and two single-ended boilers 16 ft. by 10 ft. 6 in. long, working at a pressure of 180 lb. per square inch.

On April 19th, Messrs. William Gray and Co., Ltd., launched the steel screw steamer *Eastlands*, for Messrs. Joseph F. Wilson and Co., West Hartlepool; She will take the highest class at Lloyd's, and is of the following dimensions: Length over all, 342 ft., breadth, 47 ft. 6 in., and depth 24 ft. 9 in., with long bridge, poop, and topgallant forecastle. Triple expansion engines are being supplied by the Central Marine Engine Works of the builders, having cylinders 24 in, 38 in., and 64 in. diameter, with a piston stroke of 42 in., and two large steel boilers for a working pressure of 180 lb. per square inch.

On Saturday last the steel screw steamer *Othello*, built by the Northumberland Shipbuilding Company, Ltd., Howdon-on-Tyne, to the order of Messrs. C. T. Bowring and Co., Ltd., for the Red Cross Shipping Company, Ltd., Liverpool, left the Tyne for her trial trip. The steamer is 353 ft. long by 47 ft. 3 in. beam by 28 ft. 3¾ in. deep, and has been built under special survey to the highest class at Lloyd's. Very special attention has been paid to the loading and discharging gear, and a complete outfit for the rapid handling of cargoes has been arranged for. The vessel has been constructed with a view to rapid speed and economy in fuel, the machinery having been supplied by the Wallsend Slipway and Engineering Company, Ltd. The steamer will carry 6,300 tons loaded. During construction the *Othello* has been superientended by Captain Towill and Mr. Adamson, of Messrs. G. S. Goodwin and Co., of Liverpool. The trial trip proved in every way satisfactory, a speed of eleven knots be easily obtaininged.

Amongst the guests on board were the following: Mr. Rowland Hodge (Managing Director of the Northumberland Shipbuilding Company, Ltd.), Mr. Turnbull (of the Wallsend Slipway and Engineering Company, Ltd.), Mr. F. C. Bowring (of Messrs. C. T. Bowring and Co., Ltd., Liverpool), Mr. G. S. Goodwin, and Mr. Adamson (consulting engineers, Liverpool). After the trial trip, the s.s. *Othello* returned to the Tyne to load for Bareclona.

INTERNATIONAL ELECTRIC UNITS.

THE discussion on this subject was concluded at a recent meeting of the Institution of Electrical Engineers.

Mr. F. E. Smith said the question was whether the mercury ohm was a standard one. It would appear that the mercury standard could change by about two parts in 100,000 after construction. All the disadvantages of the Clark cell except one were also disadvantages of the cadmium cell. In regard to the reproducibility of a cell it was proposed at the National Physical Laboratory to construct cells to the same specification, but of different materials; and in that way it was hoped to obtain some data for a new Clark or cadmium cell. He would point out that cadmium cells in use did not vary within 1–100,000th or 1–200,000th of a volt. Whether the cell would change after manufacture was doubtful, as no cadmium cells had been kept under observation for a long period. The Clark cell was a good secondary standard if a new definition were agreed to, and if kept at a constant low temperature while the cadmium cell was distinguished by the fact that no correction was required for temperature. It might be possible to define a particular type of silver voltameter, and then under certain conditions a very high degree of accuracy might be obtained. It was possible that the silver voltameter would be found prefereable to the standard cell as the secondary concrete unit. The mercury ohm could then be reproduced to within four parts in 100 000, the standard cell to within one part in 10,000 and the silver voltameter to within one part in 10,000.

OBJECTIONS TO THE AMPERE.

Dr. Glazebrook said his first point was an important one. It had been raised the previous week by Lord Rayleigh, and had been emphasised by Professor Ayrton, that the ampere rather than the ohm should be adopted as the secondary fundamental standard as if the ohm were adopted the result would be subject to two sources of error. That point had not been touched upon at St. Louis, but the reason for the omission was a sound one. The work at St. Louis was the consideration of the relations between sets of standards. They were endeavouring to establish a system of concrete standards acceptable throughout the world, and reproducible with fair accuracy in any properly-equipped laboratory. It was felt that the ohm, as defined by the resistance of a certain column of mercury, was a satisfactory standard, and that, therefore, only the volt and ampere had to be dealt with. With regard to Mr. Trotter's observations, he was in cordial agreement, but he would like to carry what Mr. Trotter said a step farther in one or two respects. He was glad that Mr. Trotter took the view so clearly that the English standards were defined by a certain schedule, and really had nothing whatever to do with the resistance of a column of mercury, or the electro-chemical equivalent of silver or the E.M.F. of a Clark cell. He would like to point out, however, that the concrete standard of the ohm at the Board of Trade had been calibrated by himself, and was intended to represent as nearly as could be the resistance of 106·3 centimetres of mercury under certain conditions. The other standards had a similar origin.

ORIGIN OF STANDARDS.

That brought him to a point he wished to make. If these concrete standards were universally accepted, and could be taken as standards throughout the world, then for those practical purposes with which electrical engineers were concerned, the question under discussion would cease to have any marked interest. That, however, was not the case. Attempts had been made to set up an ampere in Germany, but the same result was not obtained as in British determinations. The consequence was that concrete standards were being used now throughout the world which although derived from the same sources were not absolutely identical, and the main object of the discussion at the St. Louis conference, and at the conference which he hoped would take place shortly in

Europe, was to discuss means whereby uniformity of the concrete standards could be established throughout the world. Whether the differences to which he had alluded were important to trade was a question brought prominently before the delegates at St. Louis. The matter was of real commercial value.

AN INTERNATIONAL CONFERENCE.

These were some of the chief reasons which had led to the desire for an international conference to discuss the subject and with regard to that he was in a position to say that the British Government was prepared to assist by nominating delegates, and he hoped by greater aid even than that. Germany, Italy, and he thought he could say France, had given in their adhesion to such a conference, and he hoped therefore that the conference would take place within a comparatively short period.

Professor Silvanus P. Thompson thanked Mr. Trotter for insisting on the essential distinction between a unit and a standard. It was fundamental to the discussion that this should be clearly understood, and was far more important than the value to be assigned to a particular unit, in the second or third place of decimals. There would always be the distinction between units and standards, and it could never be corrected so that the correction could remain on a permanent basis.

It was necessary to stick to the standards as they now stood whether they agreed with the ideal units or not. With regard to the 4π difficulty, Georgi had indicated a way out without interfering with any one of the practical units, and leaving the standard ohm as the one electrical standard that was necessary.

Colonel R. S. Crompton said that the standards used must be such as were applicable in the shops, he believed that the watt and ohm would have to be adhered to.

The annual meeting of the Staffordshire Iron and Steel Institute, was held at Dudley on Saturday last under the presidency of Mr. Walter Jones. At the dinner which was subsequently held, the principal toast was that of "The Iron, Steel and Coal Trades," which was proposed by Professor Turner of Birmingham University. Mr. H. Pilkington in responding, said that at one time South Staffordshire produced not only one-third of the pig-iron, but practically one-third of the finished iron of the United Kingdom. No district, however, commanded such cheap sources of raw material as South Staffordshire, and he believed that its decline as a manufacturing district was due to the fact that we were not fighting on equal terms with competing countries. He did not think that America without her tariff walls could produce iron and steel any cheaper than could be done in South Staffordshire.

ELECTRIC LIFTINC MACHINERY.

A VERY general form of brake for electric cranes and electric machinery of all kinds, in which the load is both raised and lowered by the motor, comprises a strap, blocks, or some similar friction producing elements applied to a brake wheel by a weighted or spring lever, and taken off by a solenoid or electro-magnet in series with the motor. It forms an extremely compact and reliable form of brake. A solenoid and magnet of small dimensions will give a pull of several hundreds of pounds in intensity. Such an electro-magnetic brake serves not only to prevent the load from accidental running down, but also to stop the motor quickly.

In the best American practice in overhead travelling cranes, there is in addition to the electro-magnetic or motor brake, what is termed the main brake or the load brake. Such load brake is of the frictional self-sustaining type, inoperative during the lifting of the load. The total resistance set up by the load between the sliding frictional surfaces of the brake, is rather greater than the load itself can overcome, and thus a little work is required from a reverse running of the hoisting motor to enable the load to descend.

In electric jib cranes, such as are used on wharves, in place of hydraulic cranes, and for other services, some makers arrange to disconnect the hoisting drum or barrel from the motor and lower the load by brake, quite independently of the motor; there is then no need to reverse the motor.

As indicating the high efficiency obtained when cut gearing is used in lifting machinery, an interesting test, or series of tests, by Mr. A. G. Hansard, on an electric winch for hauling purposes has been recorded. The motor, operated by a 500 volt direct current, transmitted to winding drums through double reduction spur gearing of steel and with cut teeth. Speed reduction is from 600 revolutions per minute (speed of motor) to 24·6 revolutions (speed of drums), the ratio of the respective gears being 18 to 83 and 17 to 80. Results obtained from tests: Combined efficiency (power at brakes—electric power delivered to motor) 85 per cent. at three quarter load. The figures for full load and half load were 84·6 and 83·1 respectively. The efficiency of the motor is given as not less than 90·5 per cent. Worm gearing of indifferent make is undoubtedly very inefficient but with good design and high-class work some surprisingly good efficiencies have been obtained; 90 per cent. has been frequently given, and in one case the figure named was 97·5 per cent.

Abstract of paper read before the Birmingham and District Electric Club.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Bishop's Stortford.—Carrying out of the following works at their sewage pumping station, for the Bishop's Stortford Urban District Council: (Contract No. 1) For supplying and fixing two Lancashire boilers, 18 ft. long by 6 ft. 6 in. diameter; (2) for supplying and fixing steam pumping engine and pumps. Mr. Thos. Swathebridge, 7, North Street, Bishop's Stortford ... ... — Last Day. May 8

Edinburgh.—Supply and erection of water-tube boilers at the M'Donald Road electricity works. Town Clerk, Mr. Thomas Hunter, City Chambers, Edinburgh ... — Last Day. May 8

Huddersfield.—Supply and erection of ash-elevating plant and storage tank, also slack-elevating and conveying arrangements for feeding eleven Lancashire boilers, and for excavation and masons' work. Mr. A. B. Mountain, St. Andrew's Road, Huddersfield ... ... — Last Day. May 8

Aberystwyth.—For carrying out the proposed works of water supply for Bow Street, for the Aberystwyth Rural District Council. Mr. Richard Jones, Penrhiw, Bow Street, Aberystwyth ... ... — Last Day. May 8

Banbridge (Ireland).—Erection of a covered-in steel footbridge at Banbridge Station, for the Great Northern Railway Company (Ireland). Mr. W. H. Mills, engineer-in-chief, Amiens Street Terminus, Dublin .. .. — Last Day. May 9

Manchester.—Supply of oil for the manufacture of carburetted water gas for the Gas Committee. The oil to have a flashing point of not less than 73 degrees. Mr. Charles Nickson, Superintendent of the Gas Department ... ... — Last Day. May 10

Barrow-in-Furness.—Construction of a steel road bridge over the Walney Channel, uniting Barrow Island and Walney Island. The bridge will be about 1,123 ft. in total length between abutments and 50 ft. in length, and will consist of eight fixed girder-spans, and one opening span, on cylinder foundations. Sir Benjamin Baker, K.C.B., 2, Queen Square Place, Queen Anne's Mansions, Westminster ... ... — Last Day. May 15

Dublin.—An electric generating station, for the Dublin Port and Docks Board. The specification and drawings can be obtained at the office of the engineer of the Board, Mr. John P. Griffith, M.I.C.E., East Wall, Dublin ... ... — Last Day. May 15

Irvine.—Supply and erection of (1) buildings; (2) power-house plant (suction-gas plant, gas engines and generators, balancers and boosters, battery of accumulators, switch-board and crane); (3) mains (cable trenches, etc., converting street lamps, meters). Messrs. Kirkland and Capper, 17, Victoria Street, Westminster, London, S.W. ... ... — Last Day. May 15

London.—Supply and erection at its generating station (East Greenwich, S.E.) and maintenance for ten years, of a battery of 280 accumulator cells having capacities of 645 ampere hours at a three-hour discharge rate and of 450 ampere hours at a one-hour discharge rate. Specifications, etc., at the County Hall, Spring Gardens, S.W. — Last Day. May 16

Erith.—Dredging in the River Thames, in front of the Crossness outfall works, in the parish of Erith, in the county of Kent, for the London County Council. Chief engineer, Mr. Maurice Fitzmaurice, C.M.G., County Hall, Spring Gardens, S.W. ... ... — Last Day. May 16

Aldeburgh.—Supplying, erecting, setting to work, and maintaining in good order for three months at the new well, near Aldeburgh Hall Farm, of two "Hornsby-Ackroyd" cheap fuel oil engines, two "Hayward-Tyler" Universal pattern pumps, with all necessary gearing, shafting, pipes, valves, and other fittings, for the Corporation. Particulars of Mr. J. C. Gordon, Aldeburgh, or Messrs. James Mansergh and Sons, 5, Victoria Street, Westminster ... ... — Last Day. May 24

London, N.E.—For the Hackney Borough Council, an artesian well and air-lift pumping plant. Mr. Robert Hammond, M.I.C.E., consulting engineer to the Council, 64, Victoria Street, Westminster, S.W. ... ... — Last Day. May 25

Hartlepool. — Construction of a self-propelling barge-loading dredger, capable of lifting 600 tons per hour and of dredging to a depth of 40 ft. below water level; also for the construction of a twin-screw steam hopper barge (hopper capacity 500 tons, speed nine knots loaded), for the Hartlepool Port and Harbour Commission. Mr. J. D. Howkins, engineer, Hartlepool ... ... — Last Day. June 15

New South Wales.—Tenders will be received at the office of the Secretary for Public Works, Sydney, Australia, up to 2 o'clock p.m. on Friday, September 1st, 1905, for the manufacture, supply and delivery in the State of New South Wales of all iron and steel required by the Government. Full particulars may be obtained from the Agent-General's office, 9, Victoria Street, London, S.W. ... — Last Day. Sep. 1

COMING CONTRACTS.

Stirling. — The proposed reconstruction of Carron Bridge, at a cost of £7,500 is under consideration.

Chester. — The Town Council, after considering detailed reports from its surveyor, its electrical engineer, and its tramway manager, have resolved to carry out a tramway extension involving an expenditure of over £10,000.

Dieppe.—Extensive works for the enlargement of the harbour at a cost of £180,000 will be commenced in June.

Bristol.—Sanction has been received to the borrowing of £126,000 for electric lighting.

Fenton (Staffs.)—An inquiry has been held into the application for sanction to borrow £33,500 for carrying out a sewage disposal scheme prepared by Messrs. Wilcox and Raikes.

Bexley Heath.—The Council have applied for sanction to loans of £1,000 for electric lighting extensions and £5,000 for tramways.

Halifax.—At a meeting on Wednesday the Waterworks Committee asked for authority to lay six miles of 18-in. pipes from Albert Reservoir to Brighouse, at an estimated cost of £22,000. Tramway extensions are also proposed at a cost of some £7,000.

CONTRACTS CLOSED.

Rothwell.—The Council have accepted the tender of Messrs. James Watt and Co., Birmingham, for supplying the engines and pumps for the Stourton sewage works.

Cardiff.—Messrs. Edwards and Armstrong, of Bristol, have secured the contract for installing 3,000 electric lights and 100 inter-communication telephones at the new Town Hall and Law Courts at Cardiff.

Glasgow.—The Mirrlees Watson Company have recently received the following orders: G. Harland Bowden and Co., for J. and J. Colman, London: Surface plant. Lancashire Dynamo and Motor Company, for the Malta Dockyard: 4 sets surface plant, each 7,000 lb. steam per hour. Mr. P. J. Mitchell, London, for The Steel Company of Scotland: Elevated jet plant, 40,500 lb. steam per hour, from two Rateau exhaust steam turbines. J. G. White and Co., London, for Belfast Tramways: 3 sets surface plant, each 24,500 lb. steam per hour. J. P. Coats, Ltd., Paisley: Low-level counter-current jet plant, 24,000 lb. steam per hour. Joseph Baker and Sons, London: Surface plant, 6,250 lb. steam per hour. North Metropolitan Electric Power Supply Company, Willesden Power Station: Surface plant, 16,000 lb. per hour (repeat order). Gloucester Corporation: Surface plant, 30,000 lb. per hour. Caledonian Railway: Surface plant, 11,000 lb. steam per hour.

Dundee.—J. G. White and Co., Ltd., have secured the contract from the Dundee-Broughty Ferry and District Tramways Company for the construction of these tramways at the sum of £88,250.

Lowestoft.—The Town Council have accepted the tender of Messrs. Babcock and Wilcox, Ltd., for the supply of a boiler with superheater, at the Electricity Works, at £5,337.

North Eastern Railway.—Messrs. R. Waygood and Co. Ltd., have secured a contract from the North-Eastern Railway Company for electric passenger lifts at their new offices at York, Newcastle, and London, as well as for the Station Hotel, Hull; there are to be seven lifts in all.

Admiralty.—The Lancashire Dynamo and Motor Company are undertaking the complete electrical equipment for the power stations of three dockyards for the Admiralty—Sheerness, Malta, and Bull Point Ordnance Depôt.

London, N.—The Light Railways and Tramways Committee have given the work connected with the tramways from Tally Ho! Corner to Woodberry-grove, Ballards-lane, Finchley, and the extension of the tramways from the Edgware-road, Cricklewood, to the Metropolitan Railway Station, Willesden, to Mr. Clift Ford and Dick, Kerr and Co., Ltd.

Liverpool.—The tender of the Electrical Company, Ltd., for the supply and erection of arc lamps, posts, cables, etc., required for lighting the entrance to Sandon Dock, the north and south passages to Huskinson Dock, and the Huskinson Dock and branches (Liverpool) has been accepted by the Mersey Docks and Harbour Board.

APPOINTMENTS VACANT.

Last Day.

Devonport.—Gas engineer and manager under Corporation. Salary £450 per annum. Mr. R. J. Fittall, Town Clerk, Municipal Offices, Devonport ... ... May 8

London.—The London County Council requires the services of a resident engineer and an assistant resident engineer in the Tramways branch of the engineer's department to superintend, under the direction of the chief engineer, the laying of the track work, for the construction of new, and the reconstruction of existing, tramways for electrical traction on the conduit system. Salaries £8 and £5 per week. Mr. G. L. Gomme, clerk, Spring Gardens, S.W. ... ... May 8

Southend.—The Corporation invite applications for the appointment of borough electrical engineer and general manager of the tramways. Commencing salary £400, rising by annual increments of £25 to £500 per annum. Mr. W. H. Snow, Town clerk ... ... May 8

Lincoln.—The Corporation invite applications for the appointment of a waterworks engineer. Candidates must have had previous experience in a similar capacity with a company or a corporation supplying water to a town or district under parliamentary powers. Salary £300 per annum. Mr. W. T. Page, jun., deputy town clerk, Lincoln ... ... May 9

London.—Two additional assistants in the department of electrical engineering of the City and Guilds Central Technical College, Exhibition Road, London, S.W., to give instruction in electric machine drawing and construction and electric machine testing. Salary £150 per annum. Applications to Professor Ayrton ... ... —

APPOINTMENTS FILLED.

London.—Mr. J. C. Elvey, chief meter inspector at Ilford, has received a similar appointment under the St. Pancras electricity department.

Dublin.—The Technical Schools Committee have selected Dr. John Ryan, M.A., D.Sc., LL.M. (principal of Paddington (London) Technical Institute) for the position of expert adviser on technical education.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows:—
Consols: June 1st. General Settlements: May 12th, 31st, June 15th. Bank Rate, March 9th, 1905, 2½ per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
11,270	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2⅜ — 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	4⅜ — 4⅞
3,210,000	1	1/-	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	9⅛ — 9⅜
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅛ — 5¾
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	102 — 104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt. Debs. Red.	100	96 — 99
530,000	1	2/4½	Babcock and Wilcox, Ltd., Ord.	1	5 — 5⅛
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1 7/16 — 1 9/16
20,000	5	8/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	4¾ — 5¼
250,000	1	6¾d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 — 105
150,000	4½	2/8½	Barrow Hæmatite Steel Co., Ld., O	4½	1⅝ — 1 5/16
50,000	4½	3/-	Do. dó. Cum 2nd. Pref.	4½	4⅛ — 4⅜
33,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾ — 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104 — 106
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11⅜ — 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	99 — 101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	7/16 — 9/16
300,000	1	6¾d.	Do. 5½% Cum Pref.	1	3/4 — 5/6
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	15/16 — 1
1,860,900	1	3¾d.	Do. Nos. 1,639,101-3,500,000	12/-	½ — 9/16
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1 3/16 — 1 5/16
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1 5/32 — 1 7/32
74,000	10	5/-	Do. 5% Cum. Pref.	10	11 — 11½
154,500	5	5/-	Cammell, Laird & Co., Ltd., Ord.	5	8⅞ — 9
232,500	5	2/6	Do. 5% Cum. Pref.	5	5 3/16 — 5 5/16
450,000	1	1/2⅔	Clayton & Shuttleworth, Ltd., Ord.	1	1 3/32 — 1 5/32*
70,000	5	2/6	Do. 5% Cum. Pref.	5	5⅝ — 5 7/8*
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	100 — 103
100,000	10	7/6	Consett Iron Co., Ltd., Ord.	7½	32 — 33
57 031	10	10/-	Crossley, Bros, Ld, Ord. 40340/97370	10	16 — 16¼
40,339	10	5%	Do. 5% Cum. Pref.	10	11⅜ — 12
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2 — 2¼
1,259,594	1	3¾d.	Dorman, Long & Co., Ltd.	1	5/8 — 11/16
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	91 — 94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	3⅜ — 3⅝
250,000	1	9¾d.	Dunlop (James) & Co., Ltd., Ord.	1	1/- — 1 1/8
300,000	1	7½d.	Do. 6% Cum. Pref.	1	7/8 — 15/16
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9½ — 10½
69,754	13	12/-	Do. do. do.	10	7½ — 8
20,250	10	8/-	Elliott's Metal, Ltd.	8	4½ — 5½
5,000	10	5%	Do. Cum. Pref. 5%	10	8½ — 9½
186,748	Stk	4%	Do. Deb. 4%	100	94½ — 96½
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	11 — 11½
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100 — 103
9,000	10	10%	Fleming & Ferguson, Ltd. Ord. Nos. 1/9000	10	12 — 12½
6,000	10	5%	Do. 5% Cum Pref. Nos. 9001/15000	10	9½ — 10
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord.	3	4⅜ — 4¾
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5¾ — 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150,000	Stk	4%	Do. 4% 1st Mort. Deb Red.	100	90½ — 91½
16,800	10	—	Greenwood & Batley, Ltd., Ord.	10	4¼ — 4½
9,600	10	7%	Do. 7% Cum. Pref.	10	10¾ — 10¾
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2 5/16 — 2 7/16
344,000	5	2/6	Do. 5% Cum. Pref.	5	6 — 6¼
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	105 — 107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2 — 3
250,000	1	3/6	Hadfield's Steel F'dry Co., Ld., Ord.	1	3¼ — 3⅜
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10⅜ — 11½
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	5 — 5½
408,505	1	1/6	Harvey United Steel Co., Ltd.	1	1¼ — 1⅜
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	10¾ — 11
28,001	5	7/-	Head, Wrightson & Co., Ltd.	5	5 — 5½
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	1⅛ — 1⅜
18,000	5	3/-	Do. 6% Cum. Pref.	5	4⅜ — 5
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5½ — 6

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
750,000	1	6d.	Howard & Bullough, Ltd., Ord.	1	1⅝ — 1¾
25,000	10	6/-	Do. 6% Pref. (Non-Cum.)	10	13 — 13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 — 101
37,500	10	20	Kynoch, Ltd.	10	18 — 19
49,537	10	5%	Do. Cum. Pref. 5%	10	10⅜ — 11
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	5/16 — 3/8
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/11⅓	Leeds Forge Co, 7% Cum. Pref.	3	3¾ — 4
200,000	1	7½d	Lysaght (John), Ltd., 6% Cum. Pf.	1	1½ — 1⅝*
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	109 — 111
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11¼ — 11⅝
210,000	1	8/32d.	Measures Bros., Ltd., Ord.	1	1/8 — 15/32
75,000	1	6/32d.	Do. 5½% Cum. Pref.	1	13/32 — 15/32
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	92 — 95
21,943	5	2/6	Muntz Metal, Ltd.	5	5 — 5¼
14,248	5	5%	Do. Pref. 5%	5	4⅞ — 5⅛
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	78 — 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12 — 12¼
80,000	5	—	North-Eastern Steel Co., Ltd., 4½% 1st Mrt. Db. Stk., Red.	100	90 — 93
£250,000	Stk	4½%	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅞ — 4⅛
122,000	5	1/6	Do. 6% Cum. Pref. "A"	5	5⅝ — 6¼
50,000	5	3/-	Pease & Partners, Ltd., Ord.	10	9½ — 10
70,000	10	6/-	Do. 4% Perp. Deb. Stock	100	9⅜ — 100
£400,000	Stk	4%	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	1 15/16 — 5⅜
20,000	5	3/-	Pooley (Henry) & Son., Ltd., Ord	1	6/- — 7/-
65,000	1	—	Do. 5½% Cum. Pref.	5	4½ — 4⅝
13,000	5	—	Projectile Co. (1902), Ltd., Ord.	1	3/8 — 1/2
230,000	1	—	Rhymney Iron Co., Ltd.	5	1⅝ — 2
126,938	5	2/-	Do. New	5	1⅞ — 1¾
73,062	5	2/-	Do. 5% Mort. Deb., Red.	100	101 — 103
£330,000	—	5%	Richardsons, Westgarth & Co., Ltd., Ord. 320,001—700,000	1	3/4 — 13/16
350,000	1	7½d.	Do. 4½% Perp. Deb. Stock	100	94 — 96
£350,000	Stk	4½%	Ruston, Proctor & Co., Ltd.	10	9½ — 10
35,000	10	12/-	Scott (Walter) Ltd., Ord.	1	3/4 — 7/8
275 000	1	6d.	Do. 6% Cum. Pref.	1	15/16 — 1 1/16
300,000	1	7½d.	Do. 4% Perp. Deb. Stk.	100	94 — 96
£300,000	Stk	4%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.	100	93 — 96
£115,300	100	5%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
£97,900	100	6%	South Durham Steel & Iron, Ltd. Or.	1	2— 1¼
250.000	1	1/-	Do. 6% Cum. Pref.	1	1⅛ — 1⅜
300,000	1	1/2⅔	Do. 4½% Per. Deb. Stock	100	88 — 91
£300,000	Stk	4½%	Steel Co. of Scotland Ord. 1/49560	9	5¼ — 5⅝
£125,240	Stk	5%	Do. 5% Trust Mort. Deb.	100	106½ — 107½
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2 — 2¼
25,000	10	5/6	Do. 5½% Cum. Pref.	10	4¼ — 4½
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	78 — 81
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	17½ — 18
55,000	10	6/-	Do. 6% Cum. Pref.	10	14½ — 15
634,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	3/4 — 7/8
538,845	1	6d.	Do. 5% Cum. Pref.	1	7/8 — 1
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	98 — 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	3/4 — 3/4
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	75 — 79
£160,000	1	7½d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref.	1	15/16 — 1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½ — 10
$508495200	$100	$½	United States Steel Corp. Com. Stk.	$100	34⅛ — 34⅜
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	103⅜ — 103⅝
$162268000	$1000	5%	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	97 — 99
3,350,000	1	1/6	Vickers, Sons & Maxim, Ltd. Ord.	1	2⅜ — 2½
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	1 3/16 — 1 5/16
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	118 — 121
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	107 — 109
£1,000,000	100	4½%	Do. 4½% 2nd Mort. Debs., Red.	100	106 — 108
225,000	1	1/2⅜	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	15/16 — 1 1/16
500,000	1	7½d.	Do. 6% Cum. Pref. Ord.	1	1 — 1 1/8
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	81 — 85*
7,637	5	2/9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4⅜ — 4⅞
300	Stk	4½%	Do. Mort. Deb. 4½%	100	92 — 98
66,666	5	3/-	Willans & Robinson, Ord.	5	1 — 2
66,666	5	3/-	Do. 6% Cum. Pref.	5	1½ — 2¼
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	75 — 80
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	76 — 78

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅝ — ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum. Pf.	1	15/16 — 1
120,000	1	1/2½	Bell's Asbestos Co., Ltd.	1	1⅛ — 1⅛
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5½ — 6
100,000	5	3/-	Do. 6% Cum. Pref.	5	5½ — 6
£500,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	101 —104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red...	100	100—102
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref...	5	2⅞ — 3⅛
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	91 — 93
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord..	2	½ — ¾
150,000	2	2/4½	Do. 6% Pref.	2	1½ — 2
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92 — 95
£125,000	Stk	4½%	Do. 4½% Perp. 2nd Deb. Stk.	100	79 — 82
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	11 — 11½
40,000	5	2/6	Do. 5 % Cum. Pref.	5	5½ — 5⅝
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red.	100	107 —109
85,000	3	1/6	Crompton & Co., Ltd...	3	2 — 2¼
£100,000	—	5%	Do. 5% 1st Mort. Reg. Debs.	100	95—100%
52,000	5	10/-	Dick, Kerr & Co., Ltd.. Ord. ..	5	7⅞ — 8¼
61,000	5	3/-	Do. 6% Cum. Pref.	5	5⅝ — 6
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 —107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ — 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106 —109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1 — 1½
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1⅜ — 2¼
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	81 — 86
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	85 — 90
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	1 — 1½
31,390	2	2/9⅜	Do. 7% Cumulative Pref. ..	2	2¼ — 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 — 99
10,248	10	7/6	Evered and Co., Ltd.	10	11 — 13
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ — 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk.. Red.	100	97—101
35,000	5	10/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	11 —12
85,000	5	2/3	Do. 4½% Cum. Pref.	5	5½ — 5⅝
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	109—111
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	16 — 17
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 —103
7,500	10	—	Parker, Thos., Ltd.	10	6½ — 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/3—16/9
37,350	12	24/-	Telegraph Construction and Maintenance Co., Ltd.	12	36 — 38
£150,000	100	4%	Do. 4% Deb. Bonds	100	103 —105

III.—ELECTRIC TRACTION.

Present Amount ubscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
120,600	5	5/-	Anglo-Argentine Trams Co., Ld., Or.	5	8¼ — 8½
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅛ — 6⅛
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord. ..	10	11¼ — 11¾*
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9¾ -- 10¼
£46,300	100	5%	Do. 5% Debs., Red. ..	100	99 --102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 —100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	⅜ — ⅞
59,394	1	11·1d	Do. 5% Cum. Pf. ..	1	15/16 — 1 1/16*
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1 — 1⅛
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾ — 4¼
£425.000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	103 —106*
		%	Pref. Ord. Stock	100	100 —103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¼ — 9⅜
156,437	10	6/-	Do. 6% Cum. Pref.	10	10¾ — 11¼
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	120 ···122
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	96 —98*
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3½ — 3⅝
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5 5/16 — 5 7/16
47,000	5	3/-	Do. "B" do.	5	5¼ — 5½

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	97 — 99
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	101 —105
102,268	5	5/-	Calcutta Tramways Co., Ltd. ..	5	8¼ — 8½
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 —108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1¼ — 1½
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5 % Cum. Pref.	5	4¾ — 5
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	99 —102
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —103*
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13½ — 14½
59,987	10	6/-	Do. 6% Pref...	10	15½ — 16½
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2¾ — 3¼
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	85 — 90
125.000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10½ — 10¾
£1.031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—103
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb. Stock, Red. ..	100	101 —103
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	⅜ — 7/16
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	1 — 1 1/16
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105 —107
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½ — 1½
110,923	8	3/2⅔	North Metropolitan Tramways Co..	8	4¼ — 4½
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	105 —108
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	9 — 9½
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9½ — 10
£220,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	103 —107

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
7,500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	11¾ — 12½
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	10— 10½
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	106 —108
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5⅜ — 5⅝
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	101 —104*
27,507	5	5/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	9½ — 10½
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	9½ — 10½
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9½
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	7⅞ — 8½
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5⅝ — 5⅞
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	105 —107
41,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6½ — 7
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	109 —111
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	11½ — 12
40,000	10	6/-	Do. 6% Cum. Pref.	10	13½ — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	123 —127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 —105
40,000	10	5/-	County of London Elec. Supply Co., Ltd., Ord.	10	8¾ — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	111 —114
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	5⅜ — 6
70,000	5	3/-	Do. 6% Cum. Pref.	5	6⅜ — 6⅝*
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	106 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
10,000	5	/6	Folkestone Elec. Supply Co., Ld., O.	5	5¼ — 5⅜*
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 — 104
15,000	10	—	Havana Electricity Co., Ltd.	10	9½ — 10½
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	7½ — 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—103*
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	11/16 — 13/16
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12½ — 13

Stocks and Shares marked * are quoted ex-dividend

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount bscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	101 —103
111,000	3	1/9⅜	London Elec. Supply Corp., Ld., Ord.	3	2¼ — 2⅜
60,000	5	3/-	Do. 6% Pref.	5	5¼ — 5⅜
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red.	100	99 —101
100,000	10	11/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	18 — 19
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅜ — 5¾
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	109 —114
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	97 — 99
£250,000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	99—101%
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½—15½
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	100 —102
16,500	5	4/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼— 6½
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	101 —104
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13¾—14¾
20,000	5	3/6	Do. 7% Pref.	5	8½— 8¾
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅝— 3¼
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	79 — 83
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	4 — 4¼
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅞ — 1
50,000	1	8⅔d.	Do. 7% Cum. Pref.	1	1 15/16—1 7/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4 13/16—5 1/16
30,000	5	2/6	Do. 5% Cum Pref.	5*	5¼— 5¼
£200,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	104—106
110,000	5	7/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12½—13
28,151	5	2/6	Do. 5% Cum. Pref.	5	6 — 6½

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ — 2⅜
£763,580	Stk	15/-	Anglo-American Tel. Co., Ltd., Ord.	100	60 — 62
£3,118,210	Stk	30/-	Do. 6% Preferred Ordinary	100	106 —107
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	15⅜—15⅝
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6⅝— 6⅞
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	— — —
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	97 — 99
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¼— 8⅜*
6,000	10	10/-	Do. 10% Preference	10	16½— 17½
6,000	5	2/- 5/-	Direct Spanish Telegraph Co., Ord. 10% Cum. Preference	5 5	3⅜— 3⅝ 8½— 9⅜
£30,000	50	4½%	Do. 4½% Debs...	50	101-103%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11¼—11½
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100—102
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	99-101%*
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14½ — 14⅝
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105 —107
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	139 —142
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	91 — 93
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	106 —108*
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	35 — 37
£58,700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100—102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	50 — 52
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	⅜— ⅞
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	108½—109½
£1,966,667	Stk	5%	Do. Deferred	100	101 —103
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅛ — 5⅜
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	100—102
£689,593	Stk	4%	Do. 4% do. do. ..	100	103½—105½
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1¼ — 1⅜
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1 3/16 — 1 5/16
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	99 —102
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	8 — 8½
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7 — 7⅛
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5¼
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	107—109
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	8 — 8½
£30,008	2½	—	West Coast of America, Ltd. ..	2½	1/8— 7/16
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100 — 102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares.	Last Dividend.	Name	Paid up.	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	11/16— 13/16
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8¼ — 8½
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	8 — 8½
£80,000	100	5%	Do. 5% Deb.	100	104 —106
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13½— 14
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,915	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8½— 9*
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	98—100*
£672,900	Stk	4½%	British & African Stm. Nav. (1900), Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	97 — 99
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	5¾— 6¼
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	88 — 92
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	100 —102
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	11¾ -- 12¼
40,000	20	8/-	Do. Nos. 60,001-100,000	10	4¾— 5¼
£461,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	99—101*
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1⅛ — 1¼*
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	5 — 5⅛
36,758	8	4/9⅜	Do. Non-Cum. 6% Pref.	8	8 — 8½
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—102
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2¼— 2⅜
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3 — 3½
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	86 — 88
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5% Cum. Pref. ..	10	4½— 5
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	132 —136
£1,160,000	Stk	19%	Do. do. Deferred ..	100	229 —232
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	28½— 29½
89,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5⅛*
39,075	5	2/6	Do. "B" Ord...	5	4 — 4⅛*
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼— 8¾
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10¼— 10¾
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	100 —102

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
60,000	1	9¾d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1 1/16—1 3/16
£750,000	Stk	9%	General Hydraulic Power Co., Ltd.	100	130 —135
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15*
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	5/16— 7/16
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	1/16— 1/8
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1 3/16— 1 5/16
135,000	1	7⅛d.	Do. 6% Cum. Pref. ...	1	1⅛— 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

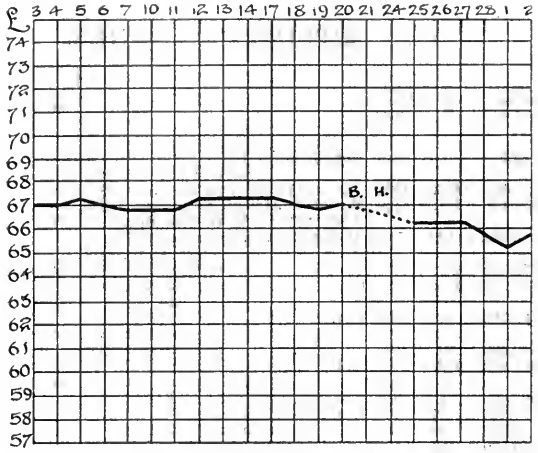
Present Amount Subscribed.	Shares.	Last Dividend.	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car, & Wagon, L., 1-10,000	10	22½ —23
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8⅜— 8⅞
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 —14
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9 — 9¼
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 — 4¼
14,567	10	1/3	Lancashire Wagon, Ord.	2	2 1/16— 2 3/16
4,150	10	5%	Do. do.	10	10½— 10¾
781,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	43/—43/6
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	24/6—25/6
235,000	1	7½d.	Do. Cum. B Pref. 6% 1-235,000	1	28/— 29/-
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 —19½

Stocks and Shares marked * are quoted ex-dividend.

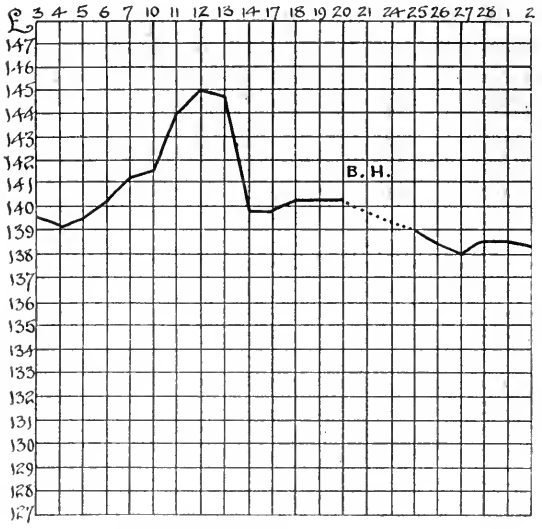
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM APRIL 3RD TO MAY 2ND, 1905.

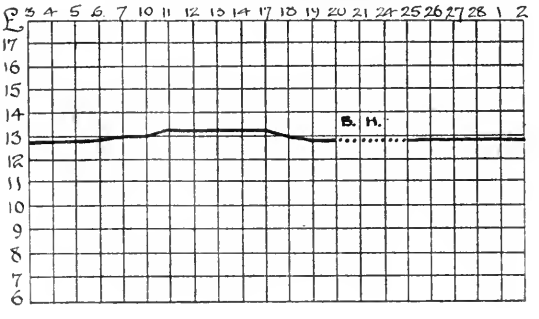
COPPER.



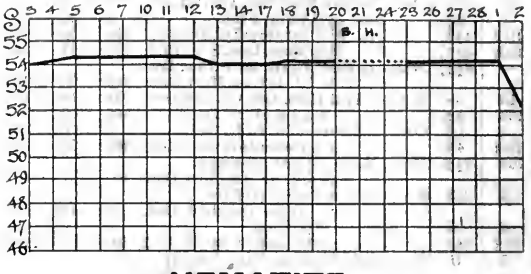
TIN.



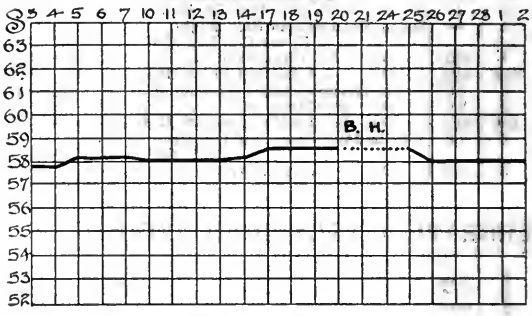
ENGLISH LEAD.



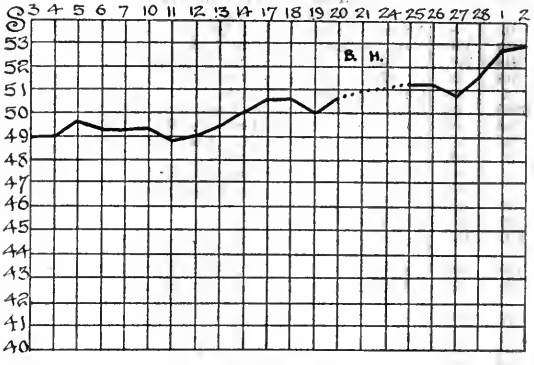
PIG IRON: SCOTCH.



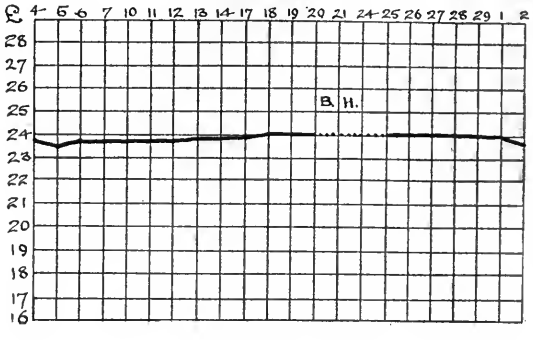
HEMATITE.



CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, May 3rd, 1905.

COPPER has weakened owing to less favourable American advices. As Mr. W. H. Barnard points out in a special circular, the takings of the Far East call for special attention, as owing to their growing volume they seem to be likely to entirely alter the outlook. In past years the following figures are recorded as representing shipments to Asia: In 1901, 1902, and 1903, 17,000 tons; in 1904, 38,000 tons; first quarter of 1905.

The purchase of these parcels in the last quarter of 1904 and early part of 1905 partly caused the excessive advance in price, and now that these orders are completed the market has drifted into a natural condition of reaction, but the question at issue is to what extent can the future be affected by the existing circumstances. The Chinese purchases are said officially to be for coinage purposes, but the coins that would absorb even 20,000 tons of Copper would represent a fairly large issue. Leading operators say variously according to their books (1) that the metal is being bought speculatively and will one day be resold, or (2) that the whole is being used for ammunition, but there seems to be still another and not impossible use for all this Copper, and that is that China is developing. In this case, the Eastern buying may become a recognised regular factor, and might be large enough to absorb this year's American production.

Tin has fallen from its high estate, the market being somewhat affected by the weakness in copper and the withdrawal of speculative support. It would appear that the bear account for the immediate future has been covered, and this accentuated the fall in cash tin with some relief to manufacturers. The outlook, however, seems to favour a fresh advance in the price of the metal, and the latest dealings show more activity, particularly for forward metal, there being some American orders in the market. The closing prices were firmer at £138 7s. 6d. cash, and £134 15s. three months.

The Lead market has been dull and principally confined to export business, but a rise in the price of galvanised iron has caused a better inquiry for Spelter, and the immediate outlook is towards higher prices. The closing quotation to-day was £23 17s. 6d. ordinaries, and £24 3s. 9d. specials.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:		£	s.	d.
DALZELL	Siemens' Steel Plates, Marine Boiler Quality ..	6	15	0
STEEL	,, ,, ,, Land ,, ,, ...	6	17	6
	,, Steel Bars, Boiler Quality	6	17	6
DALZELL	Siemens' Steel Plates, Ship Quality Plates.....	5	17	6
STEEL	,, ,, Bars ,, ,, ...	6	7	6
	,, ,, Angles.....	5	7	6
Manufactured Iron:				
Bars—Dalzell.....		6	2	6
,, Best		6	12	6
,, ,, Horseshoe		6	12	6
,, Angle.....		6	2	6
,, Best Angle		6	12	6
,, Best Best		7	2	6
,, Extra Best		7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

	£	s.	d.	
Steel Angles (Glasgow Steel).....	5	7	6	per ton.
Steel Ship Plates (Glasgow Steel)	5	17	6	,,
Steel Bars, Ship Quality (Glasgow Steel)	6	7	6	,,
Steel Bars, Boiler Quality (Glasgow Steel)	6	17	6	,,
Steel Land Boiler Plates (Glasgow Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Iron-works, Coatbridge, N.B., quote:—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best.....	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£ s. d.
Angles—Phœnix	6 5 0
,, Best	6 15 0
,, Extra Best	7 5 0
Gas Tube Hoops—Phœnix Best	6 15 0
Plates—Phœnix	—
,, Best Boiler	7 10 0
,, Best Best Boiler	8 0 0
,, Extra Best Boiler	9 0 0
Boiler Tube Strips—Phœnix Best Best	8 0 0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1. £ s. d.	No. 3. £ s. d.
Coltness, f.a.s. Glasgow	3 4 6	2 14 0
Gartsherrie ,,	2 19 0	2 14 0
Summerlee ,,	2 19 0	2 14 0
Carnbroe ,,	2 16 6	2 12 6
Langloan ,,	3 4 0	2 15 0
Calder ,,	2 19 0	—
Clyde ,,	2 18 6	2 13 6
Glengarnock, f.o.b. Ardrossan	2 18 0	2 12 6
Eglinton ,, ,,	2 14 6	2 12 6
Dalmellington, ,, Ayr	2 14 6	2 12 6
Shotts ,, Leith	2 19 0	2 14 6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£ s. d.
W.W. Bars	6 12 6
W.W. Best Bars	7 2 6
W.W. Best Best	7 12 6
W.W. Best Best Best	8 2 6
W.W. Best Shoe	7 2 6
Thornaby	8 2 6
Thornaby Best	8 12 6
Thornaby Best Best	9 12 6
Whitwell Special Admiralty Cable	10 5 0
Special Chain Iron	9 5 0
Tube and Nail Strips	6 15 0
W.W. Angle Iron	6 15 0
W.W. Best Angle Iron	7 5 0
Tee Iron, to 8-inches United	7 12 6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron. £ s. d.	Steel. £ s. d.
(BNF)	Bars	6 10 0	6 15 0
	Angles	7 0 0	7 5 0
	Tees	7 10 0	7 15 0
W.I.W	Hoops	7 0 0	7 10 0
	Sheets	7 10 0	8 0 0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets:	Singles 20 G 96in. by 36in. per ton. £ s. d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £ s. d.
"Vale"	10 0 0	10 10 0
"Shield"	10 10 0	11 10 0
"Severn"	11 10 0	12 10 0
"Baldwin Wilden B."	12 10 0	13 10 0
Charcoal	16 10 0	17 10 0
Best Charcoal	18 10 0	19 10 0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£ s. d.	£ s. d.
No. 3 Lead	13 10 0	14 10 0
S.V. Lead	15 0 0	16 0 0
No. 3 Terne	15 0 0	16 0 0
S.V. Terne	16 10 0	17 10 0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton. £ s. d.	Doubles 21 to 24 G to 96 by 36in. per ton. £ s. d.
Best Coke (Finish)	29 0 0	30 10 0
,, Charcoal (Finish)	31 0 0	32 10 0
Extra ,, ,,	33 0 0	34 10 0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.
Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.
Extreme sizes in Tin and Patent Coated specially quoted for.
Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.
At works.

Galvanized Corrugated Sheets:

	£ s. d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11 12 6	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14 5 0	,,

Galvanized Working Up-Sheets:

	£ s. d.	
24 G., f.o.b. London, in Bundles	13 12 6	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£ s. d.	
Crown Bars	6 10 0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7 0 0	,,
Angles	6 15 0	,,
,, Best	7 5 0	,,
T's	7 0 0	,,
,, Best	7 10 0	,,
Best Shoe Iron	8 0 0	,,
,, Rivet Iron	8 0 0	,,
,, Best Rivet (Special)	9 5 0	,,
,, Cable	9 5 0	,,
,, Screwing	8 5 0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts—

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½-inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis :—

2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—

2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.

Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote :—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	12	3
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	11	10½
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	0
Charcoal Tinplates :			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	7½

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes :—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:	£	s.	d	
Blooms	at 3	16	0	per ton.
Billets	at 3	18	0	,,
Sheet Bars	at 4	0	0	,,
Finished Steel :				
Bars	at 5	2	0	per ton.
Angles	at 5	3	0	,,
Tees	at 5	6	0	,,
Joists	at 4	10	0	,,
Fencing Standards	at 5	3	6	,,
Shoeing Bars	at 5	5	0	,,
Tyre Bars	at 5	5	0	,,
Half-Round Bars	at 5	10	0	,,
Heavy Rails	at 5	5	0	,,
Light Rails	at 4	17	6	,,

Structural Steelwork :

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote :—

TIN.

Tin :	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼% & 1%	137	10	0	to	138	0	0	per ton.
English Bars, f.o.b. Dis. 1¼% & 1%	138	10	0	to	139	0	0	,,
Straits G.M.B., cash Warehouse, Net	138	0	0	to	138	3	6	,,
Straits G.M.B., 3 months, Warehouse, Net	134	0	0	to	134	5	0	,,
Australian, Mt. Bischoff, Warehouse, Net	138	0	0	to	138	10	0	,,

COPPER.

Copper :	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	65	10	0	to	65	12	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	65	13	6	to	65	15	0	,,
English, Tough, Cake & Ingot, Warehouses, Net	70	0	0	to	70	10	0	,,
English, Best Select, Warehouse Net	71	10	0	to	72	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	79	0	0	to	80	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex. ship	0	12	1½	to	0	13	1½	per unit.
Regulus, Matte and Precipitate, ex ship,	0	13	4½	to	0	13	10½	,,

YELLOW METAL.

Yellow Metal :	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	6¾	per lb.
Sheathing ,, ,,	0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	23	17	6	to	24	0	0	per ton.
Blende of 50 % Net	6	9	6	to	6	12	6	,,
Calamine, Net	6	12	0	to	6	14	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	12	15	0	to	12	17	6	per ton.
Spanish, Dis. 2½%	12	11	3	to	12	12	6	,,
Lead Ore of 70 %, Net	6	9	0		—			,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	36	0	0	to	37	0	0	per ton.
Ore, 50 %, ex ship, Dis. 2½%	9	10	0	to	10	10	0	,,
Crude, ex ship, Dis. 2½ %	14	0	0	to	16	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	7	6	per flask.
Italian ,, ,, ,,	7	5	0	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.

	s.	d.
Main Coal	7	0
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	5	6
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:

	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3½)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard	7	3
Hard Nuts	6	6

Gedling Colliery.

HIGH HAZEL.		
London Brights, 4 to 8 in. cube	10	6
Large Nuts, 2 to 4 in. cube	8	6
Small Nuts, 1 to 2 in. cube	6	0
Pea Nuts, ⅜ to 1 in. cube	5	0

STEAM.—TOP HARD.		
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	6

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2½	per cwt. lb.
	Picric, Crystals	0	0	11	,,
	Tartaric ... at Manchester	0	0	10⅞	,,
Acetate of Lime:	Brown at Manchester net	9	15	0	per ton.
	Grey ,,	12	0	0	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	23	15	0	per ton.
	Sal-ammoniac, Lump, 1sts, deld. U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate ... f.o.b. Liverpool	12	12	6	,,
Arsenic:	Best White Powdered ... net	12	5	0	,,
Bleaching Powder, 35%	,,	4	10	0	,,
Borax:	British Refined Crystal ... ,,	12	0	0	,,

Coal Tar Products:

Benzole, 50/90 %	,,	0	0	6	per gal.
,, 90%	,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C.	,,	0	0	6	per lb.
,, ,, ,, 39/40° C.	,,	0	0	6½	,,
,, ,, Liquid, 97/99 %	,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b.	,,	0	1	9½	,,
Creosote, ordinary good liquid	,,	0	0	1 7/16	,,
Naphtha, Crude, 20 % at 120° C.	,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b	,,	0	0	8	,,
,, ,, 95 % at 160° C.	,, ,,	0	0	9	,,
,, ,, 90 % at 190° C.	,, ,,	0	0	10	,,
,, Rectified, flash point over 73° F. ... f.o.b.	,,	0	0	11	,,
,, Rectified, flash point over 100° F. ... f.o.b.	,,	0	1	0	,,
Naphthalene, all qualities. Pitch ... f.a.s. Manchester.	,,	1	9	0	per ton.
Copperas: Green, in bulk	,,	0	12	6	,,
,, barrels f.o.b. L'pool	,,	1	19	0	,,
Cake	,,	1	2	6	,,
Copper: Sulphate		21	17	6	,,
Cyanides: 98% minimum ... f.o.b. net		0	0	7½	per lb.
Lead: Acetate (Sugar) White, English		27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K		23	5	0	,,
,, ,, Grey		21	15	0	,,
,, ,, Brown at Manchester		16	15	0	,,
Nitrate		24	0	0	,,
Litharge, Flake		15	10	0	,,
,, Powder		16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%		15	10	0	,,
White ,, ,, Dry ,, ,, ,,		16	15	0	,,
Naphtha (Wood): Miscible, 60 o.p.		0	2	10	per gal.
Solvent		0	2	7	,,
Potash: Bichromate ... delivered England		0	0	3	per lb.
Carbonate, 90/92 % ... c.i.f Hull		18	5	0	per ton.
Caustic, 75/80 % ... ,, ,, ...		20	10	0	,,
Chlorate ... net		0	0	3 1/16	per lb.
Montreal ... in Store, Liverpool		34	0	0	per ton.
Prussiate, Yellow ... net		0	0	5	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary .. net	5	5	0	per ton.
	,, ,, ,, Refined..... ,,	6	5	0	,,
	,, Carbonated, 48 %..... ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % ..... net	6	10	0	,,
	Caustic, White, 77 %..... ,,	10	10	0	,,
	,, ,, 70 %..... ,,	9	12	6	,,
	,, ,, 60 %..... ,,	8	12	6	,,
	,, Cream, 60 %..... ..... ,,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate ..... c.i.f. Hull net	16	15	0	,,
	Bicarbonate, in 1 cwt. kegs.....	6	15	0	,,
	Bichromate.....delivered England...	0	0	2¼	per lb.
	Chlorate ..... net	0	0	3 1/16	per lb.
	Nitrate...ex quay Liverpool, ... ,,	11	5	0	per ton.
	Phosphate	9	5	0	,,
	Prussiate .....net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts).....	1	12	6	,,
	,, (Saltcake, 95%).....	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers.....	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,
Shellac:	Standard TN orange spot	7	10	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote :—

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports.....	3	7	6	,,
Manganese:	Lump c.i.f. Liverpool 10¼d.				per metallic unit.
Ochre:	French JC ..... f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk)..... c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote :—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	12	3	to	0	13	3	per unit.
Regulus, 45 to 55%.....	0	13	6	to	0	14	0	,,
Precipitate, 65 to 80% ...	0	13	7½	to	0	14	1½	,,
Tin Ores, 70 %.....	88	0	0	to	90	0	0	per ton.
Lead Ore, 70%					6	12	0	,,
Blende, 50%					6	11	6	,,
Calamine.....					6	14	0	,,
Antimony Ore, 50%.....	7	10	0	to	9	0	0	,,

Messrs. Barrington and Holt, Cartagena, quote :—

Iron Ore.

			s.	d.	
Ord. 50%, ...f.o.b.	Porman		6	4	per ton.
Do. ..... ,,	Cartagena		6	7	,,
Special low phos. ,,	Porman		7	0	,,
Do. do. ,,	Cartagena.....		7	3	,,
Extra quality do. ,,	,,	.....	7	8	,,
Special Iron Ore ,,	,,	... .	8	4	,,
Specular 58% do. ,,	,,	.....	9	4	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote :—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine.....	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks.....	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do.	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	7	5	0		7	15	0
Nova Scotia Spruce..	,,	7	0	0		7	10	0
Spruce Boards.....	,,	5	15	0		6	5	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak.....	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish..... ...	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.....	,,	0	1	2		0	1	9

Deals.

Red Archangel and Onega, 1st quality	per std	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in *italics*.

8117. J. S. Fairfax, London. April 17th.—Improvements in or relating to change-speed driving gear.

8118. W. M. Simpson, Hastings. April 17th.—Improvements in steam generators.

8121. W. Rowbotham, Birmingham. April 17th.—Improvements in or relating to engines or power generators.

8130. J. M. McMurtrie, Glasgow. April 17th.—Improvements in steam generators and apparatus connected therewith.

8134. W. Dugmore, Birmingham. April 17th.—Reflector and smoke consumer combined.

8140. J. Caldewood and S. Marston, Glasgow. April 17th.—A new or improved apparatus for connecting and disconnecting engine shafts from the driving pinions of rolling mills.

8141, R. Gaunt, Stockton-on-Tees. April 17th.—An improvement in gas and air-reversing valves as applied to gas furnaces.

8151. A. H. Preen, London. April 17th.—Improvements in variable lift of inlet valves for petrol engines or the like.

8166. Press- und Walzwerk Akt.-Ges., London. April 17th.—Rolling mill for rolling out seamless cylinders. (Date applied for June 24th, 1904.)

8198. S. R. Preston and A. Linwood, London. April 17th.—Improvements in change-speed gears.

8203. J. Scott, London. April 17th.—Improvements in valve-gears for fluid-pressure engines.

8204. W. Poulton and M. Hurd, London. April 17th.—Improvements in and relating to furnaces for steam generators and the like.

8271.—J. C. Hudson, Wimbledon. April 18th.—Improvements in pumping engines, portable or fixed.

8281. F. H. Waterhouse, London. April 18th.—Improvements in coal-drilling machines.

8284. H. A. Noalhat and G. Fournier, London. April 18th.—Improvements in automotor torpedoes.

8285. B. Bruhn, London. April 18th.—A process for the preliminary treatment of blast-furnace slags for the production of cementitious material. (Date applied for April 19th, 1904.)

8299. R. G. Gosling, junr., London. April 18th.—Improvements in forced draught apparatus for marine and other steam boiler furnaces.

8303. A. L. French, London. April 18th.—Improvements in steam traps.

8311. H. Kent-Norris, junr., Bristol. April 19th.—An improved silencer, or exhaust box for internal combustion engines.

8316. H. Vincent Blake, Manchester. April 19th.—Improvements in hydraulic rams.

8327. T. A. Gresty, Manchester. April 19th.—Improvements in sectional steam generators.

8338. A. E. Tucker, Birmingham. April 19th.—Improvements in motive power engines.

8339. C. Barter, London. April 19th.—Improvements relating to apparatus for the heating of water and analogous purposes.

8340. C. Barter, London. April 19th.—Improvements relating to apparatus for the heating of water and other liquids.

8373. T. Crossman, London. April 19th.—Improvements in controlling apparatus for supplying water to steam generators.

8381. W. R. F. Patchett and J. H. Heaton, London. April 19th.—Improvements in or relating to steam generators for motor-cars and other road vehicles.

8384. J. Stone and Co., Ltd., and W. S. Rogers, London. April 19th.—Improvements in means for protecting the rivet-head stays in the fireboxes of locomotive and other boilers.

8431. R. A. Muir, Glasgow. April 20th.—Improvements in or connected with mechanically-operated pumps.

8470, W. R. Smith, London. April 20th.—Improvements in steam and other elastic fluid turbines.

8495. F. Nuttall, London. April 20th.—Improvements in apparatus for lubricating the cylinders of steam hammers, steam engines, and the like.

8508. J. R. Duncan, London. April 20th.—Improvements in closures for plumbing traps and the like. (Date applied for September 28th, 1904.)

8516. T. J. Berryman, London. April 20th.—Improvements in speed governors.

8522. W. Judd, A. Fraser and A. R. Hardie, London. April 20th.—Improvements in and relating to speed indicators.

8545. J. Brundrit, London. April 20th.—Improvements in elastic fluid turbines.

8547. The Hon. C. A. Parsons, H. Hall and J. Turnbull, London. April 20th.—Improvements relating to glands for steam turbines and other rotary motors.

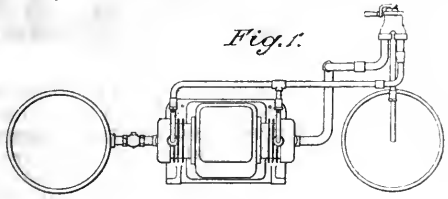
8556. R. B. Armstrong and G. H. Robinson, London. April 20th.—Improvements in screw propellers.

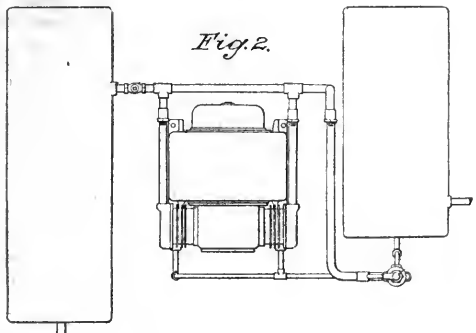
8589. J. Thompson, Manchester. April 20th.—Improvements in edge-runner grinding mills.

RECENT SPECIFICATIONS.

IMPROVEMENTS IN PNEUMATIC BRAKE APPARATUS FOR RAILWAY AND LIKE VEHICLES.

The Westinghouse Brake Co., Ltd., London. Mar. 23rd, 1905.—This invention relates to pneumatic brake apparatus for railway and like vehicles, and has for its object to provide an improved arrangement by means of which either compressed air, or vacuum brakes, may be operated at will. According to this invention, an air compressor of any suitable type is employed, connected to a motor, by means of which it is driven in the usual way. Two reservoirs are employed, one for storing compressed air, and the other for use as a vacuum reservoir. Pipe connections are made between these reservoirs and the air compressor so that, when it is desired to utilise the compressed air brakes, air is drawn into the suction inlets of the compressor from the atmosphere and delivered under pressure into the compressed air tank, whilst, when it is desired to make use of the vacuum brakes, the suction inlets of the compressor are connected to the vacuum reservoir and the air drawn from this reservoir is delivered to the atmosphere by the compressor. The change whereby the compressor may perform either the function of an air



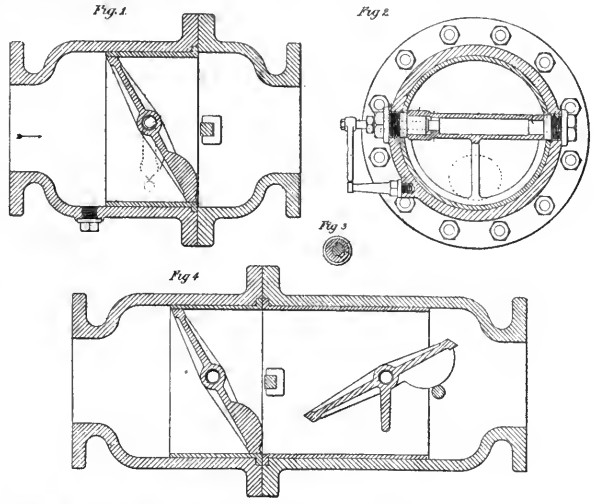


compressor or an exhaust pump is conveniently effected by means of one or more cocks located in the pipe connections between the reservoirs and the air compressor. In the drawings the compressor is shown as being driven by an electric motor.

The air compressor is caused to act either as an air compressor or as an exhaust pump as desired, and the change in its function can be made almost instantaneously and without necessarily stopping the motor driving the compressor. In the case where an electric motor is used to drive the compressor suitable means are provided so that the amount of current delivered to the motor may be modified in accordance with the demand for power either in compressing air or producing a vacuum.

IMPROVEMENTS IN CHECK VALVES APPLICABLE FOR USE AS "ISOLATING VALVES."

J. Dewrance and G. H. Wall, London. Mar. 30th, 1905.—This invention relates to non-return valves (commonly known as isolating valves) applicable



for use between the several members of a group or battery of boilers or between each such member and the steam-collecting pipe common to the entire group, for the purpose of intercepting the return flow of steam to any boiler which, for the time being, may be at low pressure, or which may be temporarily thrown out of use. The apparatus comprises a chamber in which is pivotally mounted an inclined flap or shutter. The axis of the pivots between which the flap is mounted is usually horizontal and is placed slightly out of centre, so that the area of the flap on one side of the axis is somewhat larger than that on the other side of the axis. The larger portion or wing is or may be weighted, with a view to imparting to the flap a tendency to assume the closed position. Across the casing is arranged a stop which serves to restrict the movement of the flap to that deemed appropriate. Through one of the pivots on which the flap vibrates passes a spindle, the inner extremity of which is formed as shown in fig. 3, so as to engage with the flap in such a manner as to allow thereto a certain degree of free rotative movement. Upon rotating the spindle beyond the limits of freedom so afforded it engages with the flap and by its means, the flap can be opened or closed. The outer extremity of the spindle projects through a stuffing box and is fitted with a hand lever whereby the spindle may be rocked. When the steam pressure upon the boiler side of the flap is the greater, the flap opens by reason of its unbalanced condition ; the area of one of its wings being greater than that of the other. When however, the boiler pressure falls below that in the steam-collecting pipe on the opposite side of the flap the reverse action ensues, the excess of pressure corresponding with the excess of area on one side of the axis of the flap causing the same to close automatically and to intercept the passage through the casing, thus preventing the return flow of steam.

NEW PUBLICATIONS.

"PRACTICAL ELECTRIC-LIGHT FITTING."

A treatise on the wiring and fitting-up of buildings deriving current from central station mains, and the laying down of private installation. By F. C. Allsop. Sixth Edition. With 242 illustrations. Whittaker and Co. 5s.

Attention has already been paid to the earlier editions of this work, the usefulness of which has been enhanced by extensive revisions. Mr. Allsop has avoided mathematical formulæ in favour of plain, practical instructions and simple diagrams which should be much appreciated by the mechanic.

"MECHANICAL APPLIANCES."

Mechanical Movements and Novelties of Construction. By Gardner D. Hiscox. Archibald Constable and Co. Ltd. 12s. 6d. net.

The aim of the compiler of this volume is to give enclyclopædic information concerning mechanical movements and mechanical appliances. The work, which is a continuation of the author's preceding volume on the same subject, is well arranged and its scope appears to be very comprehensive. Although the book is one that will scarcely find favour with the expert, the student of engineering will doubtless find it a handy and reliable work of reference. The illustrations, which number over a thousand, are excellent.

"TELEGRAPHY."

By Sir W. H. Preece, K.C.B., F.R.S. and Sir J. Sivewright, M.A.R.C.M.G. New Edition. Longmans, Green and Co. 7s. 6d.

This well-known text-book of telegraphy was first published about thirty years ago, and since that date there has been repeated demands for new editions of the work, which at the present day still maintains a foremost position among the manuals of science. The present edition, while retaining all the essential features of previous issues, includes descriptions of the latest devices utilised in telegraphy, in relation to fast-speed recorders, to automatic and translating apparatus for submarine currents, with Murray's improvements in the Wheatstone automatic apparatus, and with the new telegraph-switching system. Considerable space is allotted to the paper-insulated telephone cable, and also to wireless telegraphy. In the appendix have been furnished, in so far as they relate to telegraphy, the British standards for copper conductors adopted last year by the Engineering Standards Committee. The following paragraph concludes a short but lucid exposition of the laws of wireless telegraphy: "The fascination of Marconi's operations has obscured the merits of the Preece system, but, given a receiver as sensitive to the magnetic waves as the coherer is to the electric waves, there is no reason why the latter system should not be as successful as the former. Indeed there are reasons why, under certain conditions, it should be superior, for it would render unnecessary the very uncertain and capricious spark gap, it would be independent of the vagaries of the atmosphere and it would eliminate the evil of trees and vegetation."

BOOKS RECEIVED.

"The Mechanical Handling of Material," by George Frederick Zimmer. Crosby Lockwood and Son.

"A Lecture on Organ-Blowing," by Hugh Swanton. The Kinetic-Swanton Co., Ltd.

"The Telegraphists' Guide." S. Rentell and Co. Ltd.

NEW CATALOGUES.

The "Blue Print" Company, 128–130, Edmund Street, Birmingham. From this firm of draughtsmen and lithographers we have received some excellent specimens illustrating a new photo-copying process. This gives a clear black line on drawing paper or linen. The process is a patent one. The chief feature claimed for it is the absence of any shrinkage.

Princeps and Co., of Sheffield, have issued some new literature anent their "Princeps" adjustable friction-less piston ring. This is composed of two cast-iron rings, each of which is fitted with a gib over each joint. The gib piece at the joint is made of gun-metal, and dove-tailed. The internal springs exert their pressure in opposite directions. The spiral springs, which are made in numbers from four to eight according to the diameter of the cylinder, exert a uniform pressure around the internal part of the rings, pressing the same to the walls of the cylinder. The intermediate springs exert their pressure between the junk rings and the piston head, and are adjusted to give perfect and even pressure between the same. The internal band is fastened round the inside of these springs, the springs being threaded upon the band, after which they are pressed out to the inner walls of the rings and then locked. This prevents the rings from coming in, and keeps all the springs in tension continuously, thereby preventing them from shaking loose, and from any undue wear. It is remarked that this is a very essential point which is often overlooked in the construction of rings of this type. We have also received details of the firm's patent "Universal Wedge" metallic packing.

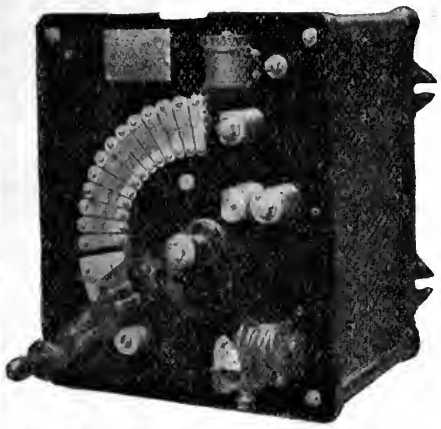
The General Electric Company, Ltd., 67, 69, and 71, Queen Victoria Street, E.C. An exceptionally well bound and printed catalogue is the eleventh edition of the firm's electrical fixture and glassware catalogue. Illustrations, drawn or photographed direct from the originals, are given in almost endless variety. The company's object in compiling this catalogue has been to render it a complete and useful guide, and a standard reference book. The contents are arranged in a systematic manner; each article has been drawn to scale; and the texture, thickness, and finish of the material, and other details of construction, are shown as far as possible. Attention is drawn to the suite of eleven showrooms which have been fitted up and wired by the company for the benefit of their clients at No. 67, Queen Victoria Street, E.C. In these are shown fittings in accordance with all periods and styles of architecture. Further showrooms are devoted to simple and inexpensive fittings for public domestic use. As regards manufacture, we are assured that particular attention has been bestowed on perfect insulation, prevention of fire risks, convenience of wiring and fixing, and durability, and great trouble has been taken to establish standard sizes of screws, threads, fixing holes, and standard dimensions of accessories. The importance to manufacturers and buyers, especially in the export trade, of acknowledged standard sizes cannot be over estimated. All articles under the headings accessories, counterweight fittings, and pendants are constructed in accordance with the principle of the H.V. system, rendering them safe from fire risks.

PAGE'S WEEKLY

Miscellaneous

"IGRANIC"

PATENTED



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A
BRITISH MADE
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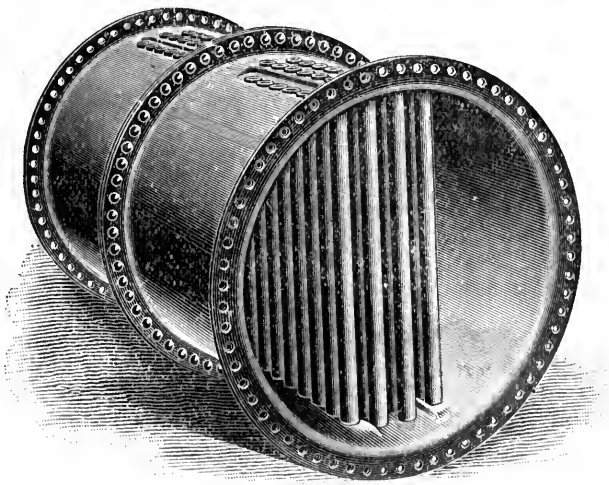
STURTEVANT ENGINEERING CO., LTD.,
147, Queen Victoria Street, London, E.C.

LEAFLET P.M. 10.

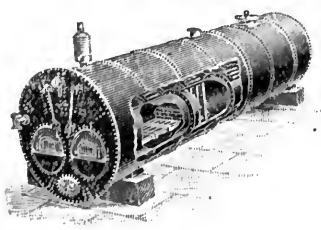
To Steam Users.

Economy in your Fuel account guaranteed by using Premier Boiler Tubes. These Tubes can be fitted to any Lancashire Boiler, and will **INCREASE** the evaporative efficiency

***20* per Cent.**



Part view of Flue fitted with PREMIER TUBES.



For Particulars apply to the Secretary—

The Premier Boiler Tubes, Ltd.,

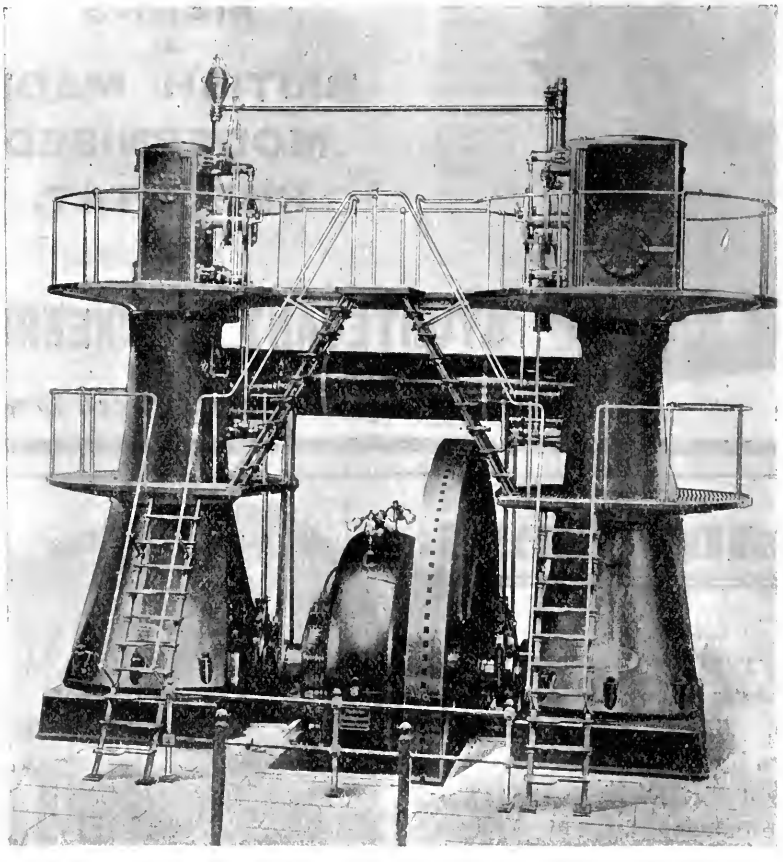
28, VICTORIA STREET,
LONDON, S.W.

Telephone No : 1638 VICTORIA.
Telegrams : "TUBULE, LONDON."

PAGE'S WEEKLY — Engines

Vertical Compound Corliss Engines and Generator

SUITABLE FOR A MILL OR WORKS.



The Engine cost £2,450. The Generator cost £1,300.

LIST OF LEADING DIMENSIONS OF 18 in. x 36 in. x 42 in. VERTICAL CROSS COMPOUND CORLISS ENGINE.

H.P. Cylinder diameter	18 in.	Main Bearings, length	24 in.
L.P. " "	36 in.	Piston rod, diameter	3½ in.
Stroke of Cylinders	42 in.	Crosshead Pin, diameter and length	6½ in. by 6½ in.
Steam Inlet, diameter	6 in.	Crank Pin, diameter and length	7 in. by 7 in.
Exhaust Outlet, diameter	13 in.	Bore of Crosshead Guide	24 in.
Main Bearings, diameter	14 in.		

GENERATOR.—300 kw Direct Current, Shunt Wound, Engine Type Westinghouse Generator, 500 volts, 8 poles, at 90 revolutions per minute, or will do 265 kw at 440 volts at 90 revolutions per minute.

FOR IMMEDIATE SALE AT A VERY REASONABLE FIGURE.

Apply to **Engine Builders,**

Box 94, "Page's Weekly," Clun House, Surrey Street, Strand, London, W.C

RICHARDSONS, WESTGARTH'S

"NESDRUM" WATERTUBE BOILER.

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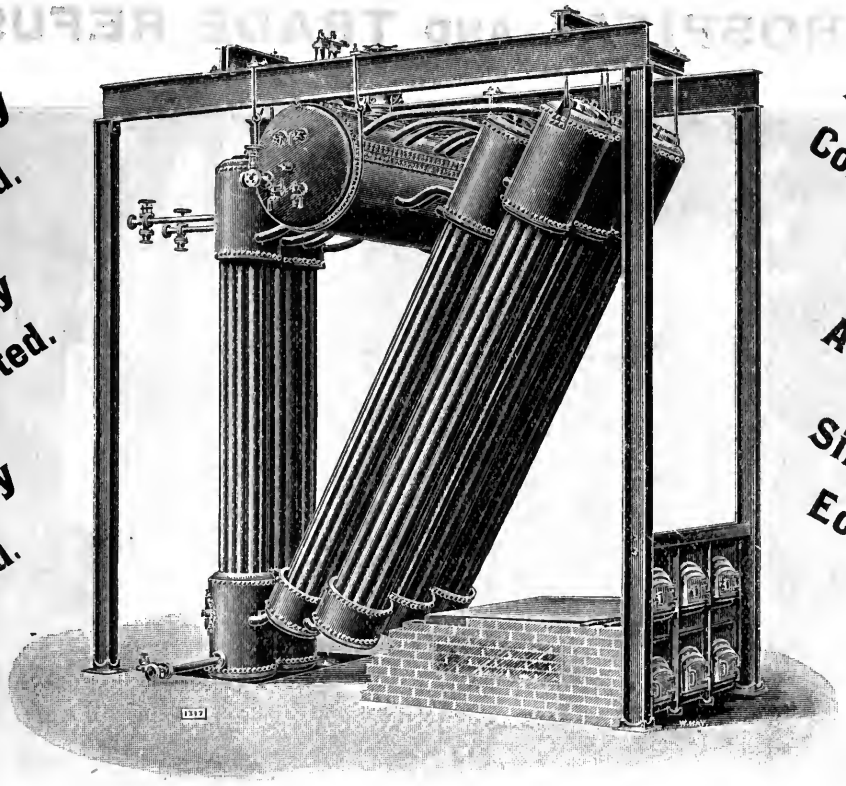

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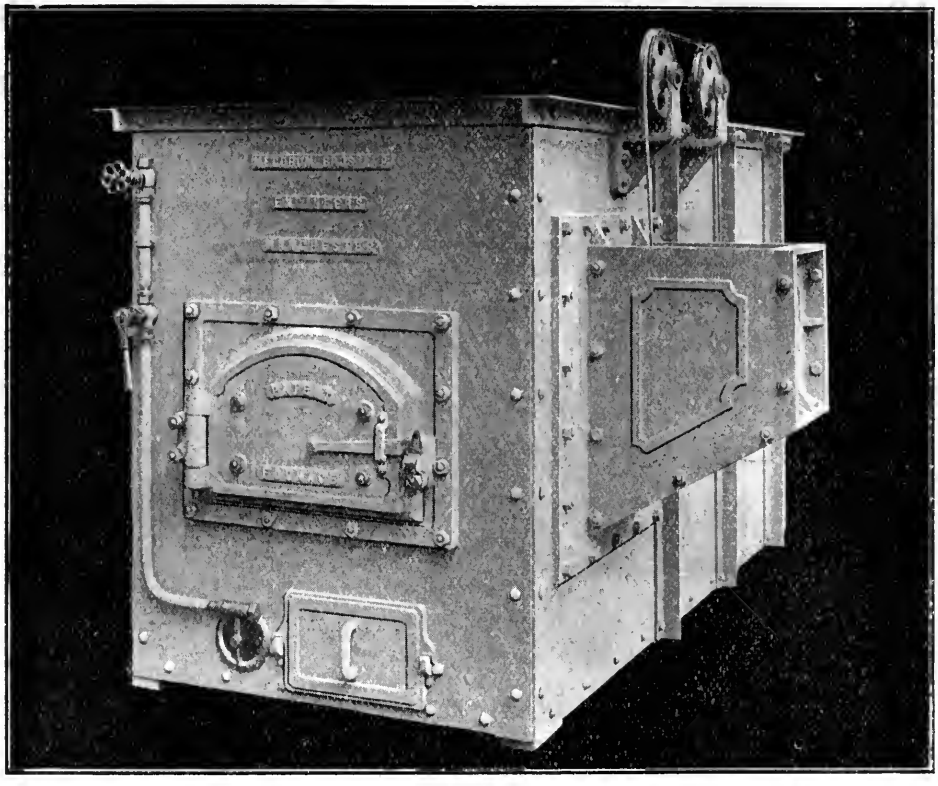

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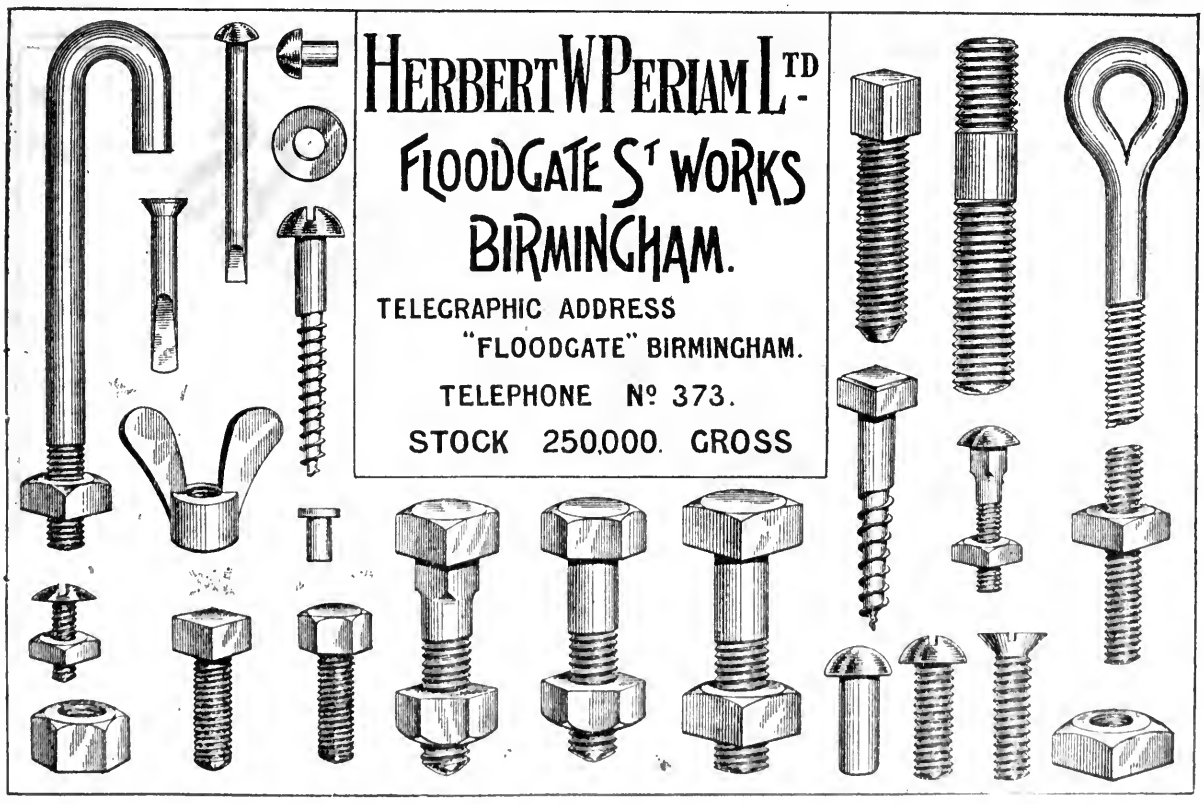

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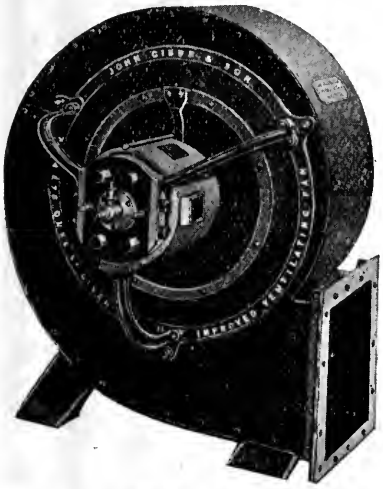

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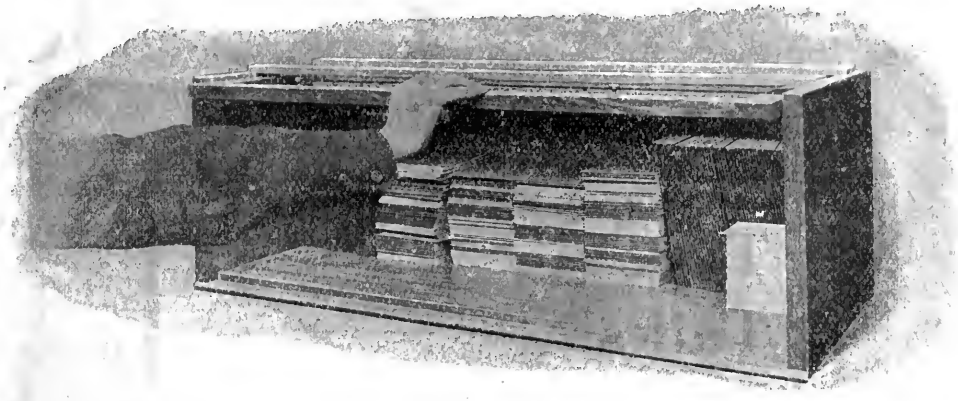

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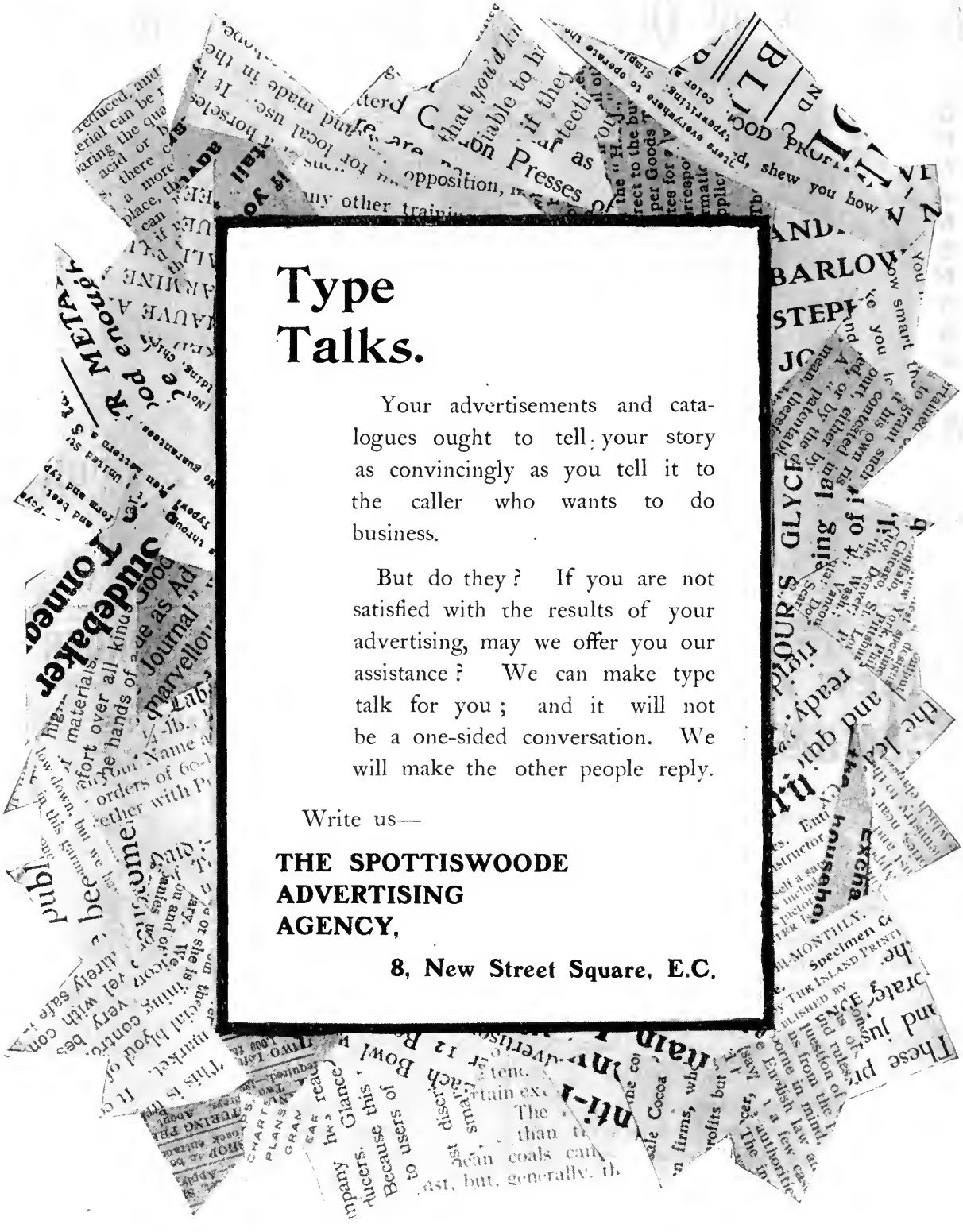

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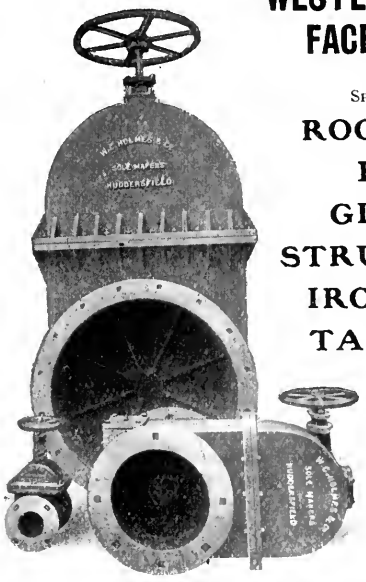

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